Engineering News-Record

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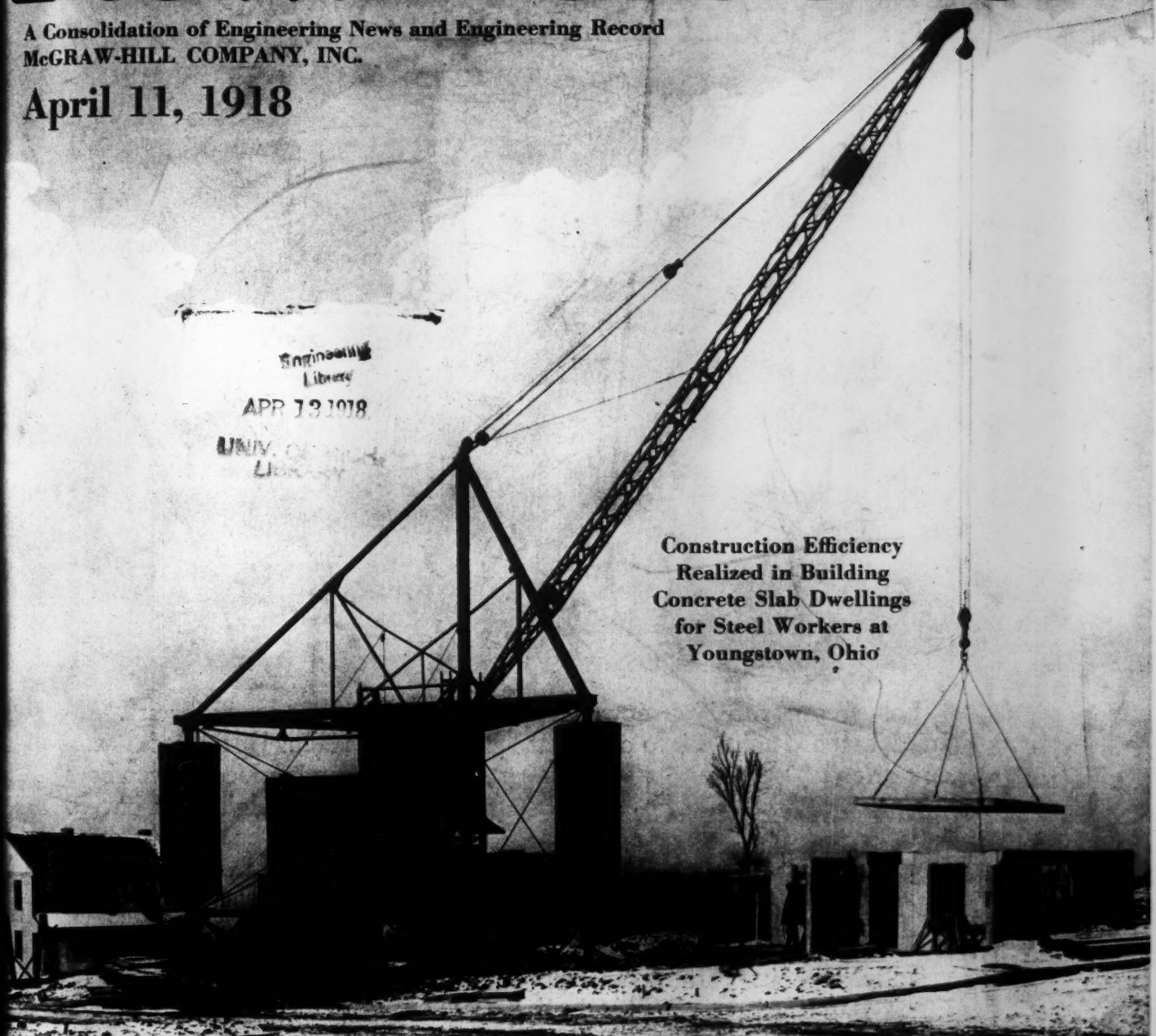

Construction Efficiency Realized in Building Concrete Slab Dwellings for Steel Workers at Youngstown, Ohio

Railway Regiment in France Handles All Kinds of Construction
By ROBERT K. TOMLIN, JR.

Labor-Saving Handling Equipment in British Ports and Factories
By HENRY VARNDELL

System in Contractor's Equipment Warehouse
By THOMAS A. BRADY

Portable Mixer Plants Build Great Concrete Reservoir at Detroit
By E. J. LIEBER

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ENGINEERING NEWS-RECORD

A WEEKLY JOURNAL
DEVOTED TO CIVIL ENGINEERING
AND CONTRACTING

E. J. MEHREN, *Editor* — CHARLES WHITING BAKER, *Consulting Editor*

Volume 80 — NEW YORK, THURSDAY, APRIL 11, 1918 — Number 15

Contractors in War Time

NEVER was it more necessary for engineers and construction men to maintain their reputation for producing the greatest results with a given amount of labor and materials. Confronted with war conditions which affect all building problems and change the very terms upon which construction work is undertaken, they are called upon to carry out a great amount of work at high speed, and with maximum efficiency. At the same time it is required of many of them that they shall finish with increased labor and material cost much public work which cannot be postponed. The problem of efficient construction methods, especially on work which is being built as much for the future as for the war, is one of special interest as the 1918 construction season opens. Methods used in keeping up the efficiency of contractors' equipment, in carrying out construction work, and in designing engineering installations to save labor are made the main subject of this issue. Then, too, makers of contractors' machinery are by no means in the rear of the procession in the matter of labor saving. Some of the things which they have done to replace labor for their customers, the contractors, by constructing machines and plant layouts designed to do the work of gangs of men, are well worth studying. It must be remembered that even in an issue devoted to this subject it is impossible to do more than scratch the surface. The effort, however, will not be wasted if the issue impresses upon every engineer and contractor that his duty to the country at the present hour is to surpass himself in the efficient use of materials, labor and time.

Where They Do Not Know There Is a War

ACCORDING to press reports there is a board of county commissioners in Hillsborough County, Fla., which considers it more important to build hard-surfaced roads for the purpose of reducing wear and tear on pleasure automobiles driven within the county than to win the war. At least this argument, reported to have been advanced by Chairman Yates, is the only one given for defying a ruling of the Capital Issues Committee against issuing and selling $875,000 worth of bonds to a road contractor. An act of this kind is evidence of plain unvarnished disloyalty and should not be tolerated by any self-respecting American. It is to be hoped that Hillsborough County, Fla., will be the only county in the United States to attempt such a selfish and unpatriotic flouting of a decision of the Capital Issues Committee with reference to proposed road construction. The committee can be trusted to decide wisely. Moreover, it represents the only agency through which we can expect to keep going all progressive construction work that does not interfere with the war program; and to have its decisions promiscuously disregarded would be to force the Government to suspend all construction work.

Construction Requirement for A.S.C.E. Membership

THE statement regarding one of the provisions of the recently rejected amendments to the constitution of the American Society of Civil Engineers which appeared on p. 539 of *Engineering News-Record* for March 21 last was in error in saying that the amendment would require construction experience for all grades of membership. The sentence, which occurred at the top of the right-hand column, should have read "full membership" instead of "all membership."

Moving Supplies for Water-Works

WILLING subordination of private to public interests is the spirit shown on p. 743 by manufacturers of water-works materials in their answers to questions as to their difficulties in moving supplies. That some of the manufacturers have had great difficulty with shipments is evident, but once a clear case is made that supplies are needed to protect the public health the way for moving them will doubtless be cleared by the Federal railway administration. This is indicated by the raising of embargoes against chemicals for use in purifying public water-supplies and against returning liquid chlorine containers, noted on p. 738.

What Our Engineers Are Doing in France

AMERICA has cause to be proud of its engineer regiments in France not only because they have proved at Cambrai and on the Somme that they can fight like men, but because they are proving daily in a hundred places beyond the roar of cannon and the rattle of machine guns that they can build fast and well the intricate engineering works through which the offensives of modern warfare are carried on. As Mr. Tomlin tells on p. 707, the "Steenth" Engineers have stuck at nothing. Short of tools and materials, they are rushing to completion at one port one of the great railway yards of the world and erecting warehouses with four times the area of the largest structure on New York harbor. Their work, distributed over a territory bigger than the State of Massachusetts, takes in

every kind of engineering construction from double-tracking French railways to building sewage-disposal plants. With characteristic energy, this regiment has scoured southwestern Europe for every scrap of construction plant that could possibly be turned to account. In a land where laborious and time-consuming construction methods have persisted right down to the present war, separated by three thousand miles of ocean from the nearest town where a man can pick up a telephone receiver and order what he lacks shipped by express within the day, these engineers are making a gallant and winning fight to build as quickly as ever they could be built at home the facilities to put the American army within striking distance of Germany and keep it there till the war is won. The efforts of this regiment should inspire contractors at home, favored with facilities for which it goes without saying those men in France would sell their shirts, to break all existing records in putting through the vast amount of work that must supplement and make effective what is being done across the water.

Keep Construction Labor Busy

ONE of the largest statistical organizations in the country has sustained the contentions of those who argue that private construction work should go forward this spring in more considerable volume. It has been found that the restriction of the use of capital by the Government for construction which could be postponed until after the war has curtailed work to the point where there is now a surplus of labor in the building trades in many sections, and also a surplus of materials which cannot be turned to immediate account in winning the war. Of course, in so far as we have energy and material to spare, any building that we can do against the time of peace is an economic advantage and a patriotic duty. There is no argument for holding back work at the present time because of high cost. Prices are not going down until the supply of currency in the country is reduced, and it is estimated that it will be from one to five years after the declaration of peace before there is any material reduction in the money cost of doing building work. This was true after the Civil War, and has been the case after all wars which have resulted in an inflation of the currency of the countries engaged. It is the duty of owners, engineers and contractors, then, to watch their local labor and material markets, keep the workmen of the building trades employed at constructive projects wherever there is not direct war work requiring their attention, and prevent lost motion from unemployment during the coming construction season.

Coincidence or Habit?

THERE is an old story of a man who fell out of a third-story window three times without apparent damage to himself, but at serious discomfort to passers-by below. When brought before a judge on the charge of impeding traffic he claimed immunity on the ground of accident. The court ruled that to fall safely out of a window is doubtless an accident; to fall twice is a coincidence, but the third time it becomes a habit.

The slippage of the upstream dike in hydraulic-fill earth dams has reached the coincidence stage. As the brief article on another page shows, the partial failure of the Calaveras dam repeated in all superficial detail the Necaxa accident of nine years ago. The dams were of similar construction, each was the highest ever attempted the type of, and the possibly fortuitous identity of the dimensions surrounding the failures is almost uncanny. At the time of the earlier catastrophe it was pointed out by numerous authorities that there were good and sufficient reasons for the slip and that engineers should be careful not to let it prejudice them against the properly constructed hydraulic-fill earth dam. Possibly when all the evidence in the later case is in the same deduction may safely be made, but it would be foolish to deny that the Calaveras slide places a heavy burden of proof on all who would advocate another high dam of this type.

According to the designer of the Necaxa dam, the late James D. Schuyler, there were at least four good reasons for its failure. These were the lack of water in the reservoir with the consequent absence of counter-pressure to withstand the thrust of the clay core; the narrow top of the upstream dike; the use of a locally available lightweight rock in the upstream fill in place of a much heavier limestone which was designed for the purpose, and the peculiar quality of the clay, which did not harden as quickly as it should.

At Calaveras the first of these causes is equally valid, for the 55 ft. of water in the reservoir only served to prevent the slide below that height. The 100 ft. of upstream dike above the back water level was in precisely the same condition as far as counterpressure goes as was the 170 ft. of fill above the dry reservoir at Necaxa. But this is a criticism of the whole system of construction because it is rare that the pool level behind a dam can be kept anywhere near the rising structure itself. On the other hand, the last two reasons seem not to apply at the California dam. Indeed the failed section of upstream fill there, instead of being of a lower grade than the rest of the dam, was a mechanically placed rock fill presumably of high stability.

There remains the fluidity of the clay core, and here the similarity is evident. No testimony has yet been given that any of the engineers on the California dam were dissatisfied with the clay used there, but the fact remains that the wet clay did take a considerable time to dry out and successive bulgings of the upstream face showed a high and unsafe pressure against that dike from the fluid clay in the core.

Here lies the crux of the hydraulic-fill question. The clay fill deposited by the hydraulic method is a highly fluid mass for some time after its deposition. In some cases, and it so happened that two of the cases are the two highest examples of the type of dam, the solidifying is so slow a process that the hydraulic pressure against the newly placed dikes becomes greater than those dikes can withstand. And the unfortunate thing about the Calaveras accident is that with the Necaxa failure before them, the experts in charge could not apparently devise any method whereby they could guarantee the stability of the upstream dike or even measure the pressure of the clay fill so as to tell when or if it was dangerously fluid.

Final decision on the accident and on hydraulic-fil dams in general must, of course, await a more thorough investigation than is now at hand. This investigation may clear up many of the things that are now obscure. At the same time, a third collapse would surely be an indication of a habit of this type of dam, and a habit which would make most engineers suspicious of its use in such high structures.

What Most Highway Departments Will Face in the Near Future

WITHIN the next few weeks in even the most northern of our states the frost will be coming out of the ground at such a rate as seriously to affect the usability of most macadam and many concrete and brick pavements over which heavy loads must be transported. Newspapers in those sections of the country through which the army trucks are passing in their trips from the lake cities to the Atlantic seaboard have already noticed the damage which has so far been accomplished. In many cases photographs of impassable stretches accompany these descriptions, and in general the trend of the criticism is to lay the whole blame upon the county or state highway engineer. Since it is the attitude of the daily press to build its news section upon a foundation of sensationalism, such explanations as will be made by the men in charge of country highways will be discounted if not altogether omitted from the accounts of such highway breakdowns.

But to engineers the situation appears unavoidable. They have known that the coming of Spring has always resulted in difficulties on many sections of roads which have carried light traffic only. They recognize that in many cases adequate drainage might have prevented much of the destruction, but they recognize, also, that in most cases the necessary money has not been available for work of this sort. Furthermore the fact is that the use being made of the roads during this time of industrial intensity is far greater than has ever before been the case.

Under these circumstances, wisdom would dictate that heavy traffic be kept off roads which are not designed to carry it under adverse conditions. Michigan has a law which makes this possible, though it is questionable whether it will be strictly enforced during times such as these. The universal cry for a more complete use of the roads in order to relieve the railroads of their abnormal burdens will probably be utilized as an excuse to evade or even violate intentionally not only statute law but the law of reason. For conditions such as we now labor under, certainly, highway engineers have in no manner been responsible, but the public whose patience will be tried and whose anger may easily arise to the point of harmfulness should be informed by the engineers of all communities that any other outcome could not reasonably be expected, and that unjust criticism of officials may prove not only harmful at the moment but may result in "taking the nerve out of the man" to such an extent that his future value might be impaired.

There is no question but that county and state highway engineers will exert every ounce of available energy to mitigate the unfortunate nature of the unavoidable condition, and in their effort they should be helped ungrudgingly by their brother engineers. It would not be out of place, in fact, for all local engineering clubs or organizations to issue a statement to the press as to what should be expected during the period from the first thaw until the ground has finally stiffened under the warm air and winds of the late Spring. The country has no time nor energy to waste on fruitless criticism, and certainly attacks upon highway officials because of the effect of seasonal conditions on the roads will prove to be disruptive of the common understanding and productive of nothing but discouragement and slackened effort.

"I Looked at the Chart and Told Him No"

THE chief executive of one of the great supply bureaus of the Government was asked by the representative of an allied power whether this country could not divert some of the supplies under certain contracts to the army of that power. Instead of hemming and hawing, calling a lot of overworked factory managers to Washington, appointing a board of men who were needed on other work to look into the matter, or summoning a conference of bureau chiefs to debate the question for a day or a week, the executive settled it directly and finally within one minute.

"I looked at the chart and told him no," as he said later in referring to the interview.

The representative of the allied power went his way without one word, knowing that he could not expect to get those things in America. For everyone knew that this executive had exact up-to-the-minute information, collected and presented by his engineers, as to just where the production of each of the thousands of articles his department was procuring stood with reference to the needs of the country. The production of those particular things was far behind the program. This executive knew how far, and why. He knew the specific causes restricting output at every plant engaged in their manufacture. Knowing this, he also knew what must be done to bring production up, and had a very good idea of when it could be expected to overtake requirements.

Contractors know that this is the way to run construction work. Therefore they have schedules for delivery of their materials. Therefore they have progress charts to check the performance of their labor. Engineers know the same thing. Therefore they exact such planning of contractors to the end that they may know when their projects will be completed and what they will cost. But a large proportion of manufacturers and other business men do not know it. The efforts of the "efficiency engineer," scouted by the old-school factory manager and discredited by failures of would-be experts who went into the field without training or equipment, have not yet borne fruit. If the branches of the Shipping Board, the various bureaus of the War and Navy departments had this method—which has become a habit with so many readers of this journal—of keeping a living, moving account of everything that was being done for them—if every manufacturer working on war contracts had it—our production would be much farther advanced. It would be possible for some master mind in Washington to know—not to

guess—the month in which we could have an overpowering army in motion on the fields of France. And that month would perhaps be far sooner than it is likely to be in reality, because the master mind or minds would have during the whole preparation knowledge as to how things were fitting together. Matters that might hold up the entire program would be foreseen. Our allies would be fed and supplied with necessities. We would avoid further transportation tangles. Conditions which disorganize our labor forces and spread dissatisfaction where there should be only one overmastering will to work could be forestalled.

Beginnings are being made. Others besides the chief executive referred to have such methods. Some of them are in the Shipping Board. Others of them are in the War and Navy Departments. But beginnings are not enough. Before we can expect to win this war we must have finished results. The business man—and his name is legion—who contemplates with satisfaction such results as are achieved by the kind of management known to contractors as "hell-raising," where the boss gets one thing and upsets everything else to do it, must be shown that there are better methods.

Engineers can help to perfect this organization that will put us on a real war footing. Those that are building ships or doing direct contract work can plan their operations down to the last detail, and pass the knowledge of what they can be expected to do and of how they are living up to their schedules on to those above them. Where there is interference from an outside agency, such a course will at least show its cause and give those in authority the chance to remedy it. Those working for Government agencies or for manufacturers who do not use such methods—and there are many engineers in such positions—can fulfil the highest obligation to their country by devoting their efforts to bringing about better ways of planning and following through production. Publicity must be used to the fullest extent. Not the kind that blasts one or two individuals or exposes some glaring mistake. That is no better than "hell-raising." But the kind that spreads the knowledge of what efficient planning and following through of production is like, and what it will do.

There is nobody to do this work but engineers. What has been accomplished so far is the result of their work, either in private plants before the war or in Government service since. The job is a big one—and every engineer must take off his coat and get to work at it if the thing is to be done.

Mining Engineers Discuss Labor

PROGRESSIVE views on the handling of the labor problem dominated a meeting last week of the New York Section of the American Institute of Mining Engineers—and those who participated in the discussion were not theorists but men who daily, and for many years, have been "up against" the labor problem. The thought most frequently expressed (by officers of such corporations as the United States Smelting, Refining and Mining Co., the Phelps Dodge Corporation, the Miami Copper Co., the Lehigh Coal and Navigation Co., and the Illinois Steel Co.) was that there must be introduced in our dealings with labor a more human attitude. Mr. Walter Douglas, of the Phelps Dodge Corporation, for example, expressed the view that the relationship which existed between owner and worker in the day of small industries when the owner knew every man working in his plant had, by some means or other, to be restored. Intelligent employment methods were repeatedly advocated, while Mr. Sidney J. Jennings, vice president of the United States Smelting, Refining and Mining Co., thought that profit sharing above a fair return was one of the surest means of securing coöperation between corporations and their employees. Mr. Young, of the Illinois Steel Co., suggested that when a certain percentage of the total stock of a corporation is owned by the employees, they should have representation on the board of directors, while Mr. J. Parke Channing, of the Miami Copper Co., warned his hearers that a radical program is sure to be advocated in this country if the employing class does not give more attention to the worker and see that his condition is improved. All of which is full of hope for a better industrial order, particularly as the views were those of men who daily are confronted with labor difficulties. If the spirit evidenced at this meeting runs throughout our industry the dangers now lurking at our doors may be overcome.

Rochester Exhibits a New Spirit

LAST week editorial comment was made on the arrangement effected by the Standard Oil Company of New Jersey whereby the workers in the Bayonne works were given a mechanism through which they might treat with their employers on the many matters that continually come between management and men. On p. 705 is reprinted the report of the United States Chamber of Commerce on the pooling of the labor resources of Rochester, N. Y.

These and other evidences indicate the new drift that has set in toward a more rational understanding of the mutuality enforced by the machine, and the universally distributed advantage which will normally result from the proper use of this mutuality. We are beginning to see that any social order which generates enmity between machine and operator, between capital and labor, and between owner and owner, between man and man, is an artificial limitation on production which brings permanent advantage to no one. We are realizing that American industry is suffering from generations of heedless management. Faulty attitudes of past years are being revealed by the strain of the nation's war-demands, and habits of use and wont, which have yielded profits in years of peace, are found to be inhibitory of production. Indeed in many cases they have proved anti-social as well.

Though one by one these impediments are being uncovered and their true character recognized, perhaps it is too early to announce that a new and more wholesome order has been born. But there are unmistakable evidences that the prejudices and biases of a narrow, individualistic, machine industrialism are being swept aside and are being replaced by policies which are honestly based on the ultimate good of the community. If the war does no more than establish this new attitude, its horrors and destruction will have been a low price to pay for the well-being of this and future generations.

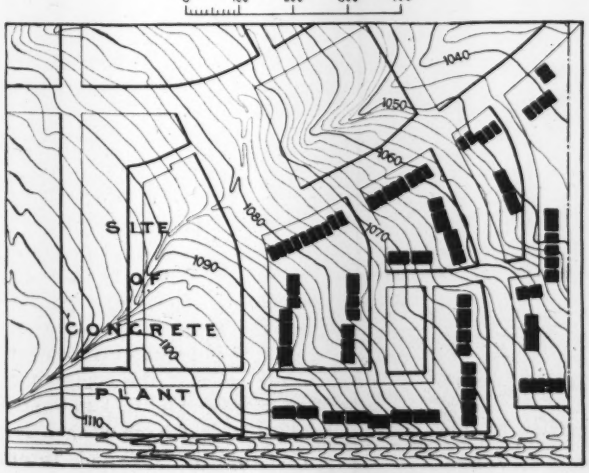
Unit-Built Concrete Cottages To House Foreign Labor

Dwellings in Youngstown Sheet & Tube Co.'s Village Built of Precast Slabs Erected by Traveler—Efficient Plant Pours 6000 Yd. in Sections Ranging from Sills to Large Wall Panels

PRECAST slabs, poured in a yard and erected by a traveler, are being used for the first time in this country to construct dwelling houses. The so-called unit method of concrete construction, which is patented by the contractors and has been extensively developed in the railway field for small bridges, railings, train-sheds, and also for warehouse roofs and elevators, is being successfully applied to the construction of 146 dwellings for the first section of a community center being developed by the Youngstown Steel and Tube Co. through its subsidiary, the Buckeye Land Co., for its employees. Located on the hill north of this company's plant, east of Youngstown, Ohio, this settlement marks one of the first attempts to provide living quarters of a permanent and inexpensive type which will be comfortable, sanitary and practically fireproof. The success of the experiment is made possible by the almost indestructible character of the buildings, and by the low cost which could be secured through erecting a large number of houses at one operation.

The method of construction allows the concrete plant to operate continuously regardless of the progress of the other work, and greatly reduces the cost of forms. These advantages, according to the contractor, much more than offset the added cost of rehandling and erecting the slabs after they are cast, which is the only item that would not be required if the houses were poured in place. The use of concrete casting platforms, granulated slag cores for forming hollow wall slabs, and of a traveling erection derrick mounted on towers, characterize the work.

The buildings now under construction will house 146 families, giving most of them four rooms and bath, on two floors. Three different types are being used; one consisting of a unit accommodating one family only; another to house two families, and another for three families. The families in the two- and three-family types are, however, completely separated from each other. These different one, two- and three-family types are combined into groups of several units, varying according to the size of the plot upon which they may be built.



MAP OF SECTION OF SITE NOW DEVELOPED

The 146 families will be accommodated as follows: 34 families in the one-family type; 52 in the two-family type and 60 in the three-family type.

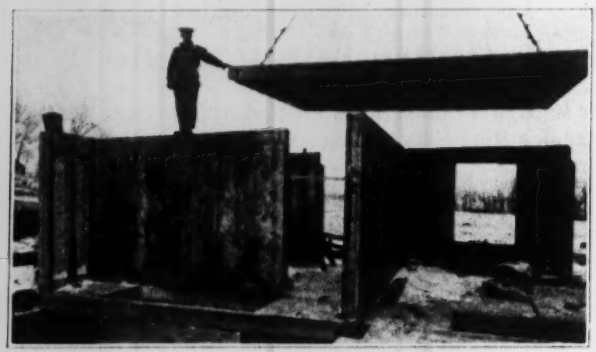
Each unit has a cellar, which is arranged so that each family has a laundry of its own. All of the apartments contain four rooms, with the exception of the middle apartments of the three-family houses, which consist of three rooms each. The houses are arranged in rows as shown on one of the drawings, so that there are many party walls, reducing the cost of construction.

Because of the uneveness of the site, all of the streets laid out being on a considerable grade, the houses could not be built at the same elevation. In order to standardize all of the slabs, it was desirable to establish a uniform step between units in each row of houses. It was found that by arraning the groups as shown and adopting a uniform difference in elevation of 3 ft. between floors of adjoining houses, all the buildings now planned could be fitted to the site with very little grading. The section through the houses shows how the slabs fitted together, and the details adopted to make the joints between slabs waterproof.

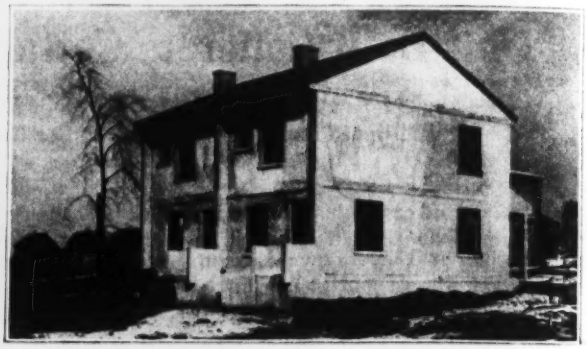
The dividing walls between houses are hollow, while all other slabs cast are ribbed. The exterior slabs are set with the smooth face out and the ribs, with wood inserts, form studs to which a lath and plaster wall is secured on the inside. The ceilings of the basement and the first floor are beamed, the smooth side of the slab being turned up. With the ceilings of the second floor, however, the ribbed side of the slabs are turned up, leaving a smooth ceiling below. The window and door openings are cast in the wall slabs, but the window sills are cast separately. After the sills are placed, wooden door and window frames are fitted.

The roof design is of timber framing with 1-in. plank sheathing, on which a red tile roof is nailed. The gable ends are made with triangular concrete slabs. These red gable roofs on the white buildings are expected to give a very pleasing architectural effect.

A casting yard through which runs a trestle track from which the slabs can be cast by chuting from a side-gate car is laid out at the top of the hill, where it will not interfere with any of the houses now being built. Parallel to the trestle and located on the uphill side is a standard-gage track for the locomotive crane which stacks and handles the slabs. Uphill from this, on the side toward the street by which materials are received and near the middle of the yard, is located the concrete plant. This consists of a two-bag batch mixer supplied with material by a car on a narrow-gage track which runs beneath bins into which motor trucks dump the sand and crushed slag through gratings.

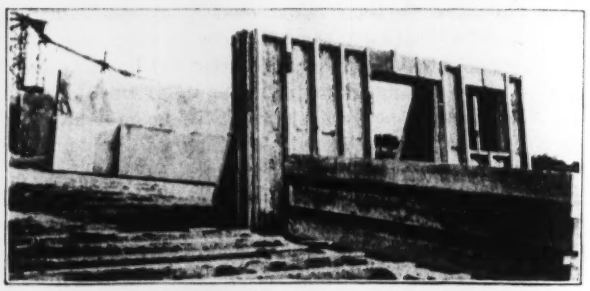


CEILING SLABS PICKED WITH FOUR-PART SLING

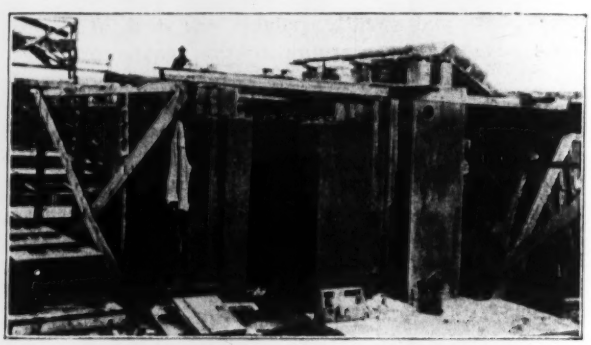


HOUSES ARE PRACTICALLY INDESTRUCTIBLE

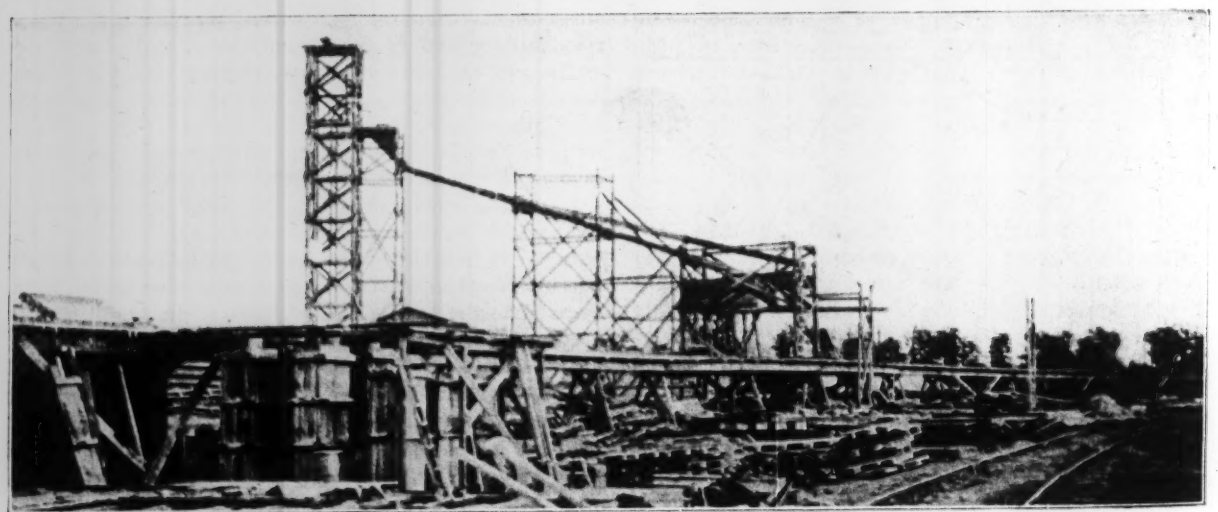
SLABS STACKED AND HANDLED BY CRANE



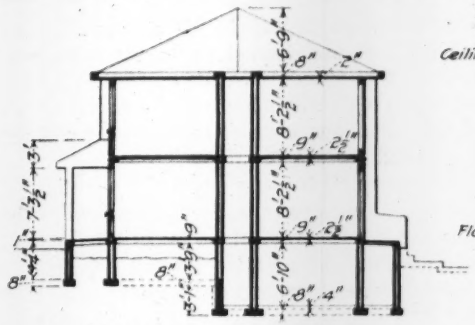
ALL FORMS FURRED FOR LATH AND PLASTER



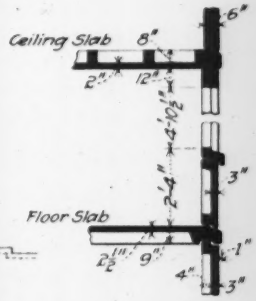
MANY SMALL PIECES SUCH AS CHIMNEYS REQUIRED



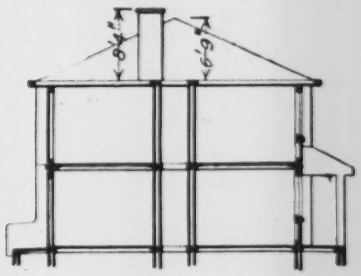
CONCRETE DISTRIBUTED THROUGH CASTING YARD BY SIDE GATE CARS ON ELEVATED TRESTLE



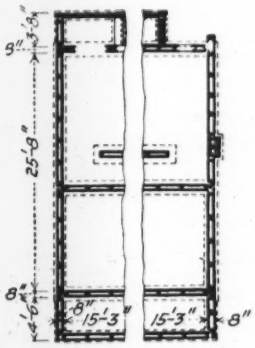
SECTION, LEFT-END HOUSE



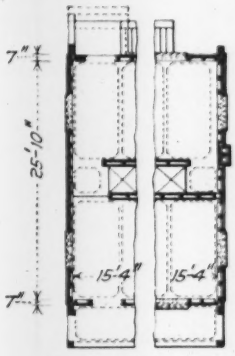
TYPICAL DETAIL



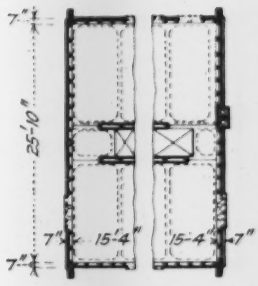
SECTION, RIGHT-END HOUSE



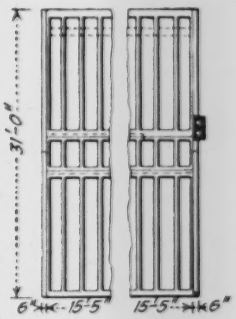
LEFT END RIGHT END
FOUNDATION PLAN



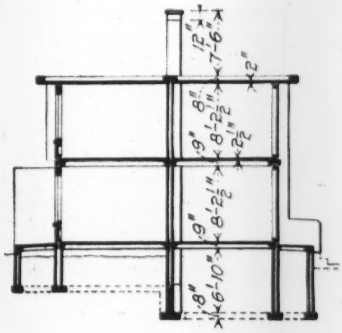
LEFT END RIGHT END
FIRST-FLOOR PLAN



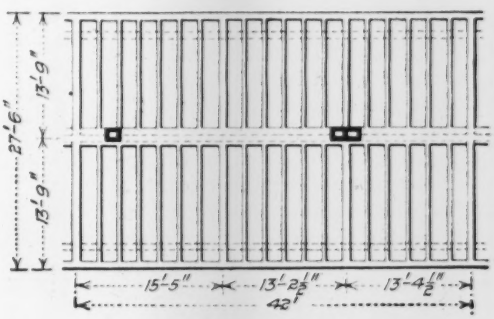
LEFT END RIGHT END
SECOND-FLOOR PLAN



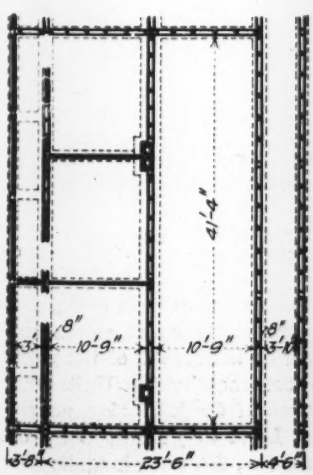
LEFT END RIGHT END
CEILING PLAN



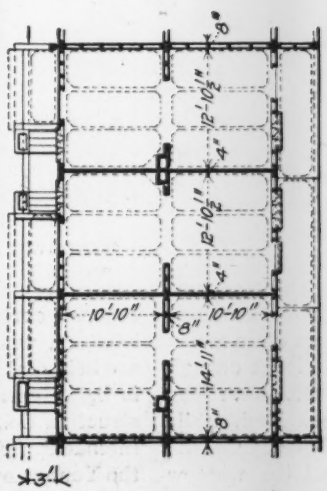
SECTION



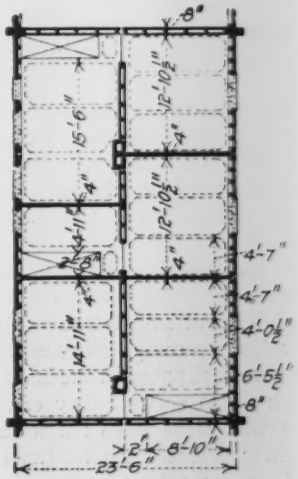
CEILING PLAN



FOUNDATION PLAN

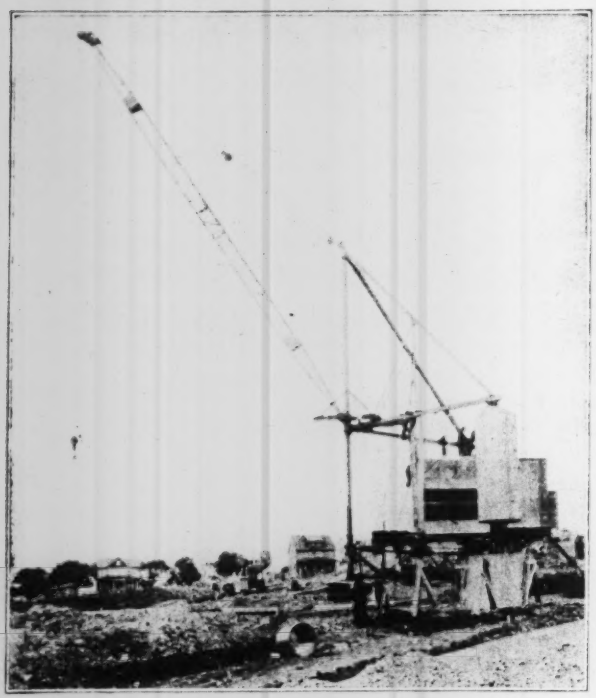


FIRST-FLOOR PLAN



SECOND-FLOOR PLAN

HOUSES FITTED TO HILLSIDE WITH THREE-FOOT STEPS AND SLABS MADE UNIFORM



HOUSES ERECTED WITH TRAVELER DERRICK

As the ground rose several feet in the length of these bins behind the mixer, it was possible to put the narrow-gage track in a cut, construct bins on top of it, and still drive motor trucks from the ground over the bins without having to climb a ramp.

Because the distributing track was located on the opposite side of the crane track from the mixing plant, a short tower was built so that a chute line from the tower to the hopper for loading the concrete car could be placed high enough to permit the crane to pass the concrete plant. Sand, slag and cement are supplied by three motor trucks which work ten hours a day.

Work was first started in the casting yard on the single family and three-family houses, 150 concrete beds and 100 timber beds being required to keep the mixer plant going on slabs for these two types. One form is poured at a time, though of course one batch will fill several of the small forms, such as those for window sills. Two men handle, fill and empty the car on the trestle, while five or six men work in the larger forms and do the finishing. As soon as the concrete has set, the side forms are stripped and match marks are painted on the edges of the concrete. The slabs are allowed to set from two days to a week, depending on the weather, then raised from the beds and stacked on edge with others of the same type. The hoisting is done with wire rope slings and hooks, which are hooked into eye bolts embedded in the concrete. The heads of these bolts come inside the form, recesses being cast around them large enough to permit slipping in the hook. The floor slabs have four such rings so that they can be suspended level, while the wall slabs have rings only in the top edge. The lighter pieces, such as the chimneys and the window ledges, are set by hand and hoisted in bundles with a sling.

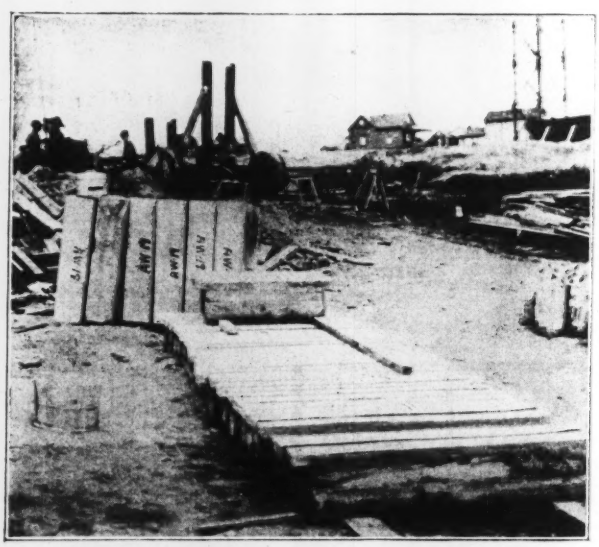
The large slabs are carried to the erection derrick in a vertical position and loaded on a car with wooden wheels and upright standards wide enough to hold four or five sections. This car is hauled by a truck, on which slabs and small sections are also loaded. A small portable mixer is used for the footings.

The slabs are unloaded and placed by a stiffleg derrick mounted on three columns, the back pair of columns being surrounded with wood-stave tanks filled with dirt for counterweight. The entire rig weighs 100 tons. The foot of each of these columns rests on a casting containing four rollers, the entire casting being rotated at will with respect to the column and held in place by a pin. This feature makes it possible to turn the traveler on a short radius. The boom is telescoping, and its length can be varied from 50 to 84 ft. The entire rig is patented.

The slabs are set in cement mortar, being handled and placed in the same manner as are masonry blocks in other work.

In addition to the concrete materials, the other work done on the site requires the delivery of 15,000 to 20,000 tons of slag, bituminous road surfacing and building materials. All these must be hauled up a steep hill, a one-way distance of a mile and a half. A 1-ton, a 2-ton, and a 5-ton motor truck are employed constantly, in addition to the trucks on concrete work, and from time to time other trucks are hired.

The road work consists of grading, laying a 4-in. slag base and a bituminous surface and putting down



WINDOW LEDGES—THE CART IN THE BACKGROUND HANDLED BIG SLABS

concrete curbs and gutters which are cast in place. In addition, water and sewer systems for the settlement are being laid in trenches dug by hand. All of the work is being carried out under contract by the Unit Construction Co., and is in charge of C. D. Morley, superintendent. For the Buckeye Land Co., a subsidiary of the Youngstown Sheet & Tube Co., the work is under the general direction of P. C. Kuegle, who is engineer of buildings.

Compressed Air Tunnel Driven Around Lock To Check Leak in Wall

Work Completed Without Interference with Water Level in Canal— Unusual Methods Employed by Contractors

By S. S. Hammel
Superintendent, The Foundation Company, New York City

In order to stop a heavy leak which threatened the ultimate undermining and destruction of Lock No. 3 on the Cayuga and Seneca Canal at Seneca Falls, N. Y., a tunnel was driven under compressed air beneath the walls of the lock, the leak located in a bad stratum of rock and effectively checked with a concrete cutoff wall. The small size of this tunnel, 4 x 6 ft. net section, required special equipment for handling muck and concrete. On account of the large volume of the leak a heavy battery of boilers and compressor equipment had to be ready for emergency service at all times.

The methods employed permitted the completion of the job without interfering with the water level in the canal.

The Cayuga and Seneca Canal is a branch feeder of the New York State Barge Canal. It connects the northerly ends of Canandaigua Lake, Seneca Lake and Cayuga Lake, and empties into the Barge Canal at Montezuma, N. Y. At Seneca Falls, between Seneca Lake and Cayuga Lake, is a dam with a power house and twin locks, Nos. 2 and 3. These twin locks have a combined lift of 51 feet from El. 381 to El. 432 above mean sea level. Lock No. 3, which is the upper of the two, has a lift of 39 feet.

Shortly after completion of the locks and filling of the upper pool, a leak showed itself when the water was lowered in the chamber of lock No. 3. The leakage increased until it became too great to be carried by the weep holes in a two-foot concrete bottom which had been laid in the lock chamber to prevent scouring. This bottom would not resist the pressure of the head of water which it had to stand when the lock was empty, and was forced upward in several places.

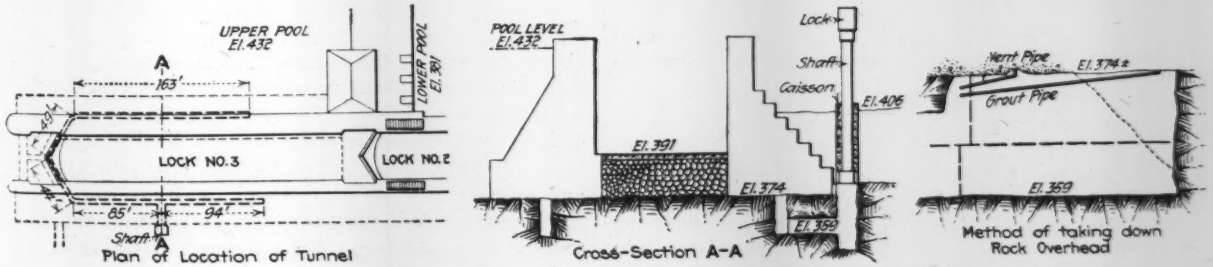
Early in the spring of 1917 it was estimated that the leak amounted to about 70 cu.ft. per second, and seemed to be increasing. It was decided by state engineers that it was necessary to repair the leak to prevent undermining and destruction of the locks. It then became a problem to determine the general locality of the leak. The flow of water showed in several places in the lock chamber, but as these places were the points where the floor had been upheaved they determined nothing. There was also a leakage out through the ground behind the land wall of lock, the ground level there being about 26 feet below the level of the upper pool. This led the engineers to think that the leak was through some particular stratum of rock below the bottoms of the lock walls. The walls from one end to the other were not founded on the same stratum of rock. Profiles of the rock showed that the concrete had been placed on a surface at about El. 374 for about half the length of the walls from the upper ends and on a surface at about El. 362 for the lower ends of walls, there being an abrupt drop from El. 374 to 362. In making this drop several strata of rock had been crossed, one of which the engineers knew to be of poor quality. It then seemed the most plausible assumption that the leak would be found in this stratum of poor quality rock and at the drop in the bottoms of the concrete walls.

Methods of grouting were considered, but discarded for something more definite. It was decided to drive a tunnel under compressed air beneath the walls of the lock at about the elevation of this stratum of rock of poor quality. By this method it was thought the leak would be located, and if the tunnel was then filled with concrete would provide a cutoff wall under the main walls of the lock.

A reinforced-concrete caisson 8 ft. 4 in. x 9 ft. 4 in. containing horseshoe shaped collapsible steel shafting was built up and sunk behind the land wall of the lock as near the upper end as practicable. This caisson was sunk from the ground elevation behind the wall, which was 406, to rock at El. 372. A hole 8 ft. square was excavated in the rock down to El. 353. When sunk, the top of the caisson was about 5 ft. above the ground.

The steel shafting was raised to hold the air lock above the elevation of the upper pool. This made a shaft 89 ft. in depth from top door of air lock to bottom of pit excavated in the rock. From this shaft an entrance tunnel, 8 ft. wide and 6 ft. high, with bottom at El. 359, was driven a distance of 26 ft. toward the lock chamber. This distance reached a point beneath the center of the south wall of lock.

The main tunnel was then driven both east and west



TUNNEL WAS CARRIED ENTIRELY AROUND UPPER PART OF LOCK EIGHT FEET BELOW FOOTINGS

from the end of this entrance tunnel. The east branch was driven 94 ft. until it reached the step in the base of the concrete lock wall. The west branch was driven 85 ft. to a point opposite the intersection of the upper breast wall with the south lock wall. An angle of 60°, a course of 45 ft., an angle of 60° and a course of 49 ft., and another angle of 60° carried the tunnel around under the upper breast wall and started down the north wall of lock. The tunnel was then driven 163 ft. to the step in the base of concrete of north wall.

Specifications called for a tunnel 4 ft. wide and 6 ft. high, but it was difficult to blast rock in so small a hole and it broke more nearly 5 ft. wide and 7 ft. high. During the driving of the tunnel some pockets of poor material and some small leaks were encountered, but nothing to make so great a leak as was indicated by the disturbance of the water in the lock chamber.

The roof of the tunnel being at El. 366, there was about 8 ft. of rock between it and the bottom of the concrete walls, 374 being the mean elevation of the bottom. A series of test holes 8 ft. apart were drilled in this rock overhead. They indicated readily that the leak was passing through a porous seam of material just underlying the concrete walls. Pipes were fitted in these test holes and grout was forced into them under pressure until they refused to take more.

The test holes showed that the main leak was located directly under the walls at the intersection of the upper miter sill and the outside or north wall of lock. A little different procedure was used in the case of this main leak to insure only proper results. The lock chamber was filled, thus equalizing the pressure on both sides of the wall under which the leak was located. This stopped any flow of water through the channel of the leak. About 300 bbl. of cement were required to grout the holes which led into this channel. After grouting, the pressure on the north wall was kept equalized for five days. At the end of this time when the water was lowered there was no evidence of any leak, showing that the grout had done its work.

The next step was to remove the rock overhead and extend the top of the tunnel to the base of the original concrete walls and fill the tunnel with concrete, making a cutoff wall. Beginning at the farthest end of the tunnel, a section about 30 ft. long of the rock overhead was taken down and the space filled with concrete. In placing concrete the old benching method was used.

After the first section had been filled a different method was adopted for taking down the overhead rock and filling with concrete. There was about 8 ft. of rock to come down. On account of the narrow width of tunnel, this was too much to be taken down with one round of drilling and blasting. Four feet of it was taken down and a 6-ft. bench of concrete placed. This made a platform from which to work to take down the remaining 4 ft. of rock.

In the top bench of concrete, pipes were placed for grouting. Pipe No. 1 led from the bulkhead at the front end of the section to a point at the roof near the back end. Pipe No. 2, with an elbow and short nipple, led from the bulkhead to a pothole shot in the roof near the front end of section. After the top bench of concrete was placed as close up to the roof of the tunnel as was practicable and allowed to set for 24 hr., the grouting machine was hooked up to pipe No. 1, and grout was forced through this pipe until it filled the joint between the old and new concrete, rose up in the pothole, and was forced out the vent pipe No. 2. This insured a tight joint on the top of the cutoff wall. This method of taking down the rock overhead, filling with concrete and grouting the joint in sections was followed until the tunnel was filled.

When the rock was taken down at the intersection of the upper miter sill and the north wall, the cross sectional area of what had been the channel of the main leak and had been filled with grout was clearly shown. It was an area shaped like the segment of a large circle with a cord length of 11 ft. and middle ordinate of 27 in. The grout which filled the opening was solid and free of anything foreign, showing that the leak had a clear channel of 12 sq.ft. cross-sectional area.

AIR LOCK WAS KEPT ABOVE UPPER POOL LEVEL AND AMPLE COMPRESSOR CAPACITY PROVIDED

Both for excavation and concreting the material was handled in dump cars specially built for this tunnel. Trucks of 24-in. gage flat cars were surmounted by wooden bodies of ½ cu.yd. capacity hinged under the middle for dumping. There was a 24-in. gage track laid the full length of the tunnel with a turntable at the intersection of the entrance tunnel with the main tunnel under the south wall. The bottom of the shaft being 6 ft. lower than the bottom of tunnel permitted dumping the cars of muck directly into the caisson bucket handled by a derrick at top of shaft. When concreting, an inclined platform was set up in the shaft about 5 ft. above the bottom of tunnel. Concrete was dumped from the bucket, handled by derrick on the platform, and thence moved by gravity into the car.

The contracting firm was well equipped with plant for this piece of work. There being but one shaft, only one derrick was required for handling labor and material in and out of the tunnel. Another derrick was set for unloading coal and handling sand and gravel direct from barges to mixer. Temporary buildings consisted of boiler house, compressor house, sandhog house, storeroom, cement house, blacksmith shop, pipe fitters' shanty and office.

The power plant was uncommonly good. Three locomotive boilers totalling 300 hp. were set up in battery and one 80-hp. boiler laid outside in case it should be

needed. Three large low-pressure air compressors and one medium size high-pressure machine were set and ready for action on short notice. One of these low-pressure machines furnished air for the tunnel during almost the entire job. Occasionally a leak was encountered that required two compressors for short periods.

The box for the shaft caisson was ditched about 8 ft. in the open before the air lock was placed. Air was turned on Aug. 2, 1917. The shaft was built up and sunk 26 ft. through broken shale and 19 ft. through rock, a tunnel 6 ft. x 8 ft. was driven 26 ft. The main tunnel, 5 ft. wide with average height of 14 ft., was driven 436 ft. in shape of a horseshoe. Leaks were grouted and stopped, tunnels were filled with concrete, and air was taken off Dec. 18, 1917. Eight days of this time was chargeable to work on an additional spur tunnel not included in the original contract. Counting out these eight days, air should have been taken off Dec. 10, 1917.

The work was done by the Foundation Company, under the direction of W. B. Taylor, district manager for the company in that territory. The writer was superintendent in charge of the work. The State of New York was represented by H. C. Smith as resident engineer and C. H. Swick and L. W. Bently as inspectors on the work.

Bonus for Laborers Increases Yardage and Lowers Cost of Paving

In Face of Severe Labor Shortage, Flint, Mich., Contractor Speeds Up Work By Paying Premium to Every Man in Gang

BY CLARENCE E. RIDLEY
Engineer in Charge of Pavement Construction, Flint, Mich.

COSTS per square yard of paving were reduced from 21 cents to 12 cents, yardage was increased from 3390 to 5485 sq.yd. in a two-weeks period, and labor turnover was reduced by the City of Flint, Mich., which is constructing by day labor approximately ten miles of pavements and thirty miles of sewers this season. The city had experienced a great deal of labor difficulty. The chief industry of Flint is the manufacturing of automobiles, which has made heavy inroads on the supply of skilled labor. Extensive building contracts under way have further increased the labor shortage.

This article will endeavor to explain how production was increased and cost decreased on one concrete foundation job in spite of these severe labor conditions.

The particular crew in question had been a problem all season. Foremen had been changed four times, and the entire personnel of the crew at least as many times. Changing foremen and laborers and giving a bonus only to foremen were all to no avail, the cost remaining above the estimate and the quantity of work done fast falling below the schedule.

This contingency led the writer to figure out a bonus system, whereby every man on the job would share according to the amount of work done. The proposition was made to the men that each man on the job should receive a bonus of one cent per square yard in excess of his regular wages for all over 500 sq.yd. of 6-in. foundation placed in a 10-hr. day. The gang was limited to twelve men, exclusive of the foreman. Previous to this as many as sixteen men were allowed. The gang was composed of a foreman at $4.17 per day, an engineer at $4, a fireman at $3.33, a cement carrier at $3.75, three concrete men at $3.50 and six shovelers and wheelers at $3.50 each.

At the above wages and allowing to each man the one cent bonus per square yard for all over 500 yd., the unit costs would vary as follows: 300 yd., 15.6; 400 yd., 11.7; 500 yd., 9.4; 600 yd., 10.0; 700 yd., 10.4; 800 yd., 10.7; 900 yd., 11.0; 1000 yd., 11.2.

As seen in the foregoing, approximately 500 sq.yd. per day would give the minimum cost, but where the overhead expense is considered, to say nothing of the desirability of getting through a job with as little inconvenience as possible to traffic is taken into account, almost everybody would be unanimous for the 1000 sq.yd. per day, with only a difference of 1.8 cent per square yard.

Now as to the practical side of the method. The payroll of this particular gang referred to, previous to the time of trying the bonus method, amounted to $708.68 for a two-weeks period, during which time they placed 3390 sq.yd. of 6-in. 1:6 concrete foundation on pavements varying from 21 to 24 feet in width. The average for the twelve days was 283 sq.yd. per day at a cost of nearly 21 cents per square yard.

The next payroll of the gang on the same kind of work, including the bonus, amounted to $646.45. In the same period of time they deposited 5485 sq.yd. at an avearge cost of less than 12 cents per square yard. During the first period the weather was such that no delay was necessary, while during the second period rain interfered with the work on six different days and on two days they were unable to operate at all. In spite of this handicap the gang averaged 548½ sq.yd. a day. One day with weather permitting them to run only 9 hr. they placed 882 sq.yd. The result was an increase of 62% in yardage and a decrease in cost of 43%, compared with the previous two-weeks period.

The fact that the aim of the ordinary laborer is realized with the end of the day's work and not in the amount accomplished, has convinced the writer that the above instance is doubtless the only solution of a difficult situation in a city where men can quit one job and get four others in as many hours if they desire. The time is past when ordinary laborers can be driven to work, and so it should be, but if the above method and good treatment of the men will solve some of our labor problems, with mutual benefit to all concerned, why cannot similar methods be worked out in other construction work of a like nature?

To Increase City Efficiency

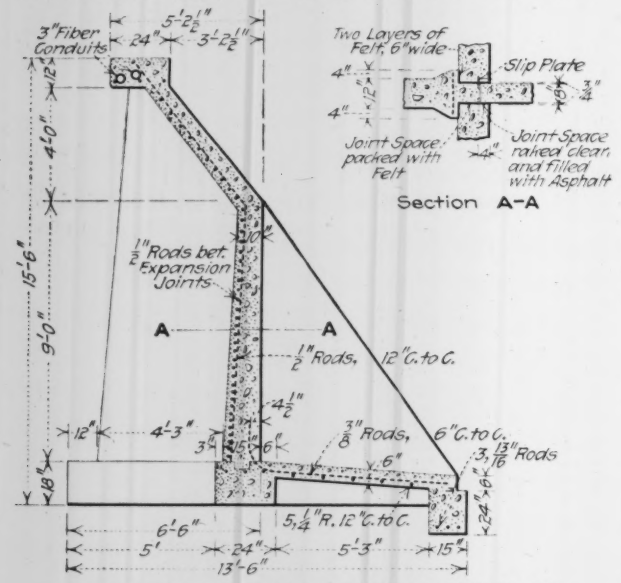
In the hope of securing increased efficiency in city administration at Cleveland, Mayor Davis announced at the recent annual banquet at the City Service Club that he was going to request that organization to arrange for stated meetings for the discussion, by city department and division heads and secretaries, of problems arising in connection with their daily work for the city.

Great Concrete Reservoir Built with Portable Mixers

Structure Above Ground Has Counterfort Walls With Unusual Expansion Joints—Holds 45,000,000 Gallons Materials Delivered by Industrial Track

By E. J. Lieber
Construction Engineer, Department of Public Works, Highland Park, Mich.

PORTABLE mixing plants to which materials were hauled on industrial track by gasoline locomotives, were used entirely in constructing the big reinforced-concrete reservoir completed recently at Highland Park, Mich. One of the largest structures of its class, this basin, entirely above ground, has a capacity of 45,000,000 gal. and contains 13,000 cu.yd. of concrete. Its counterfort walls have specially-designed water-proof expansion joints, while the floor is underdrained and provided with a hydrant system for cleaning the reservoir. Built directly by the city, the construction plans were carefully worked out to secure the structure


3" Fiber Conduits
Two Layers of Felt, 6" wide
Slip Plate
Joint Space packed with Felt
Joint Space raked clean and filled with Asphalt
Section A-A
1" Rods bet. Expansion Joints
1/2" Rods, 12" C. to C.
3/8" Rods, 6" C. to C.
3/16" Rods
5/8" R. 12" C. to C.

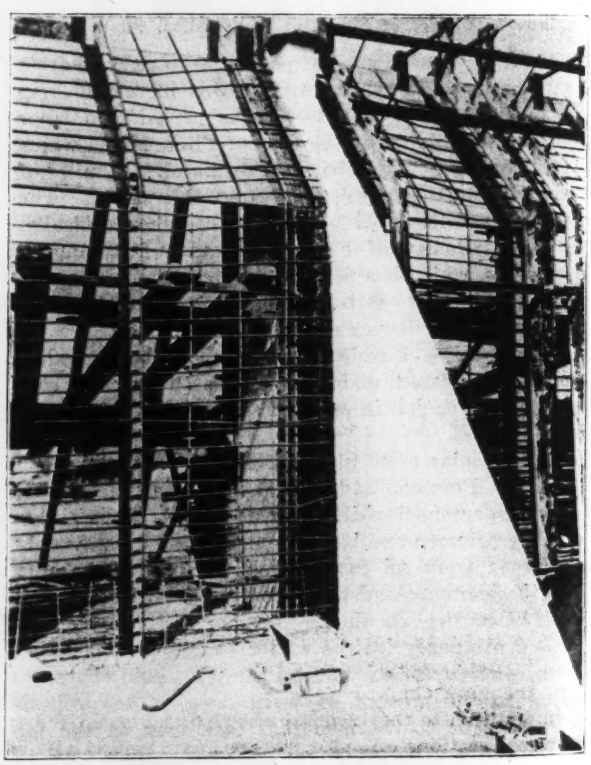
SLIP PLATES USED IN EXPANSION JOINTS AT COUNTERFORTS

desired with economy. A number of new features, including an inlet system arranged to prevent currents within the reservoir, mark the design.

Due to the rapid growth of the population of Highland Park from 27,000 in 1912 to 38,000 at the present time, accompanied by an increased demand from factories and automobile works, it was found necessary to increase the old water-supply. The new reservoir, which forms a part of the enlarged system, is located in the northeast corner of the city and is 57,000 ft. from the intake at Lake St. Clair. A pumping station at the lake supplies the new reservoir. At the reservoir itself a second pumping station delivers the water after it passes through the filter beds into the clear water well.

The reservoir as constructed is 1373 ft. long by 294 ft. wide, outside dimensions, and 14 ft. deep. The structure is reinforced-concrete throughout. The floor, except in gutters and adjacent to the main wall, is 4 in. thick, reinforced with wire mesh. The footings on which the main wall and piers rest were sunk to blue clay. These footings are 18 in. thick where the blue clay was encountered at the average elevation, and were reinforced with upper and lower layers of rods. Counterforts and abutments supporting the main walls were placed at intervals of 12 ft. c. to c. The mats for footings supporting the counterforts are 13 ft. long and 7 ft. deep.

At intervals of 52 ft. along the main wall the pier formed by the counterfort and abutment was made into an expansion joint. These expansion joints were built in advance of the main structure and are 66 in number. At each expansion joint a pedestal block is built on which an ornamental lamp post is erected. A 3-in. conduit pipe is placed in the main wall with cast-iron handhole boxes at the base of these lamp posts for the lighting system. The expansion joints were formed in the manner shown in detail on the drawing. The wrought-iron slip plates were set in the steel forms and held accurately in position by them while the concrete was poured. Before the adjoining section of the wall was poured, a strip of tin bent into the shape of a U was fastened over the projecting edge of the slip plate



COUNTERFORTS CONCRETED BEFORE WALLS

by sewing wire back and forth through the holes in it. This U shaped tin strip was fastened back on the slip plate to only half of its depth, providing a space in the concrete of the wall into which the plate may be pushed when the wall expands.

Waterproofing trowel mastic was spread over the outside of the slip plate and tin. Also a layer of felt 1 in. thick was fastened against the face of the counterfort in the space just back of the slip plate. The felt extended from the top of the footing to the bottom of the coping. Before this felt was placed the concrete back of it and the face of the projecting buttress alongside were given a brush coat of asphalt, at a penetration of 70, as a primer. The felt was pressed into this while it was still hot and another coat of the waterproofing material spread over the exposed surface of the felt before the concrete was poured.

The joint space in the coping and immediately above the upper end of the felt strip, and the joint space in front of the plate, were formed by using board strips ¾ in. thick. These boards were pulled out after the concrete of the wall set and the space left was filled with a waterproofing compound specially prepared on the ground from the proper proportions of trowel mastic, asphalt and tar primer.

The main inlet conduit is a line of 54-in. reinforced-concrete pipe. This enters the reservoir from the gate chamber, which is located at the center of the south wall of the reservoir. The main inlet extends the entire length of the reservoir along its center line. At the northern end this conduit divides into two branch inlet conduits which extend from the center of the reservoir to the sides along the north wall. At intervals of 13 ft., 12-in. circular openings are provided in the pipe which delivers the water into the reservoir. These branch conduits are made up of equal lengths of 36-in., 30-in. and 24-in. reinforced concrete pipe with reducers between. At the south end, resting on a cradle beam 6 ft. above the floor, is a similarly arranged conduit. This is the outlet system and delivers directly into the gate chamber.

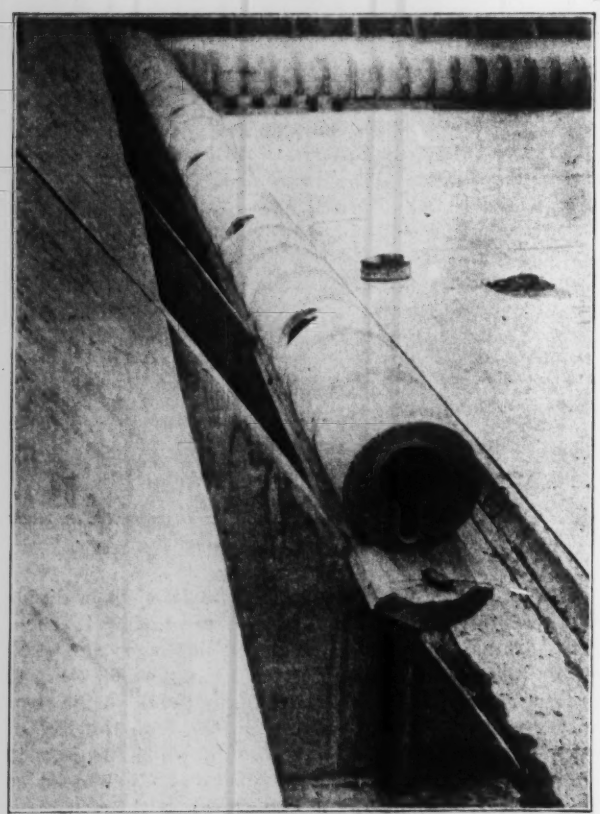
In addition to the 12-in. openings at every third joint between sections of pipe, a 1-in. hole was left for the escape of air from the conduit should any be entrapped in it. The object of this inlet and outlet system is to prevent currents in the reservoir as far as possible, as the water will have ample time for settling in coming back across the reservoir.

The gate chamber has two compartments, the inlet and outlet chamber. These are connected with a 42-in. sluice gate so that the water may flow from one chamber to the other without entering the reservoir. Another 42-in. sluice gate is provided in the outlet chamber at the floor elevation in case it should be necessary to draw the water that low. Provision is made for a 48-in. future supply main. An underdrain system is provided for cleaning the reservoir. Twelve-inch cast-iron cross drains placed 32 ft. c. to c. divide the reservoir into four parts. Perpendicular to these cross drains are the floor gutters which carry the wash water into them. These gutters are placed 52 ft. c. to c. thus requiring the water from any point on the floor to travel but 25 ft. to reach a gutter. On the line of each cross drain are 6-in. hydrants which project 12 in. above the floor. A 6-in. vitrified clay pipe embedded in gravel is also placed in the trench with each cross drain to prevent seepage from saturating the ground under the floor of the reservoir. These pipes are connected to risers which are connected in turn to tile drains laid parallel to the cross drains just beneath the floor and covered with gravel Three steam shovels were used in the excavation and the material disposed of in the immediate vicinity. Sixty-five thousand cubic yards were removed at a cost of 28 cents per yard. All the material was handled with a 1-yd. clamshell. The material storage yard consisted of a main lead with four spurs capable of storing 26 cars, and was located near the reservoir. Two gasoline industrial engines and twenty industrial cars carried the concrete materials from a bin which was filled by a clamshell. Two thousand five hundred feet of industrial track was used. This was placed on the concrete floor of the reservoir and moved about to suit the demands of the mixer. Two ¾-yd. mixers were used to pour the footings and the floor. Two hundred yards of concrete formed an average day's run on the footing for each mixer, while an average of 10,000 sq. ft. of floor was poured per day by each mixer. Ten hours constituted a day's

MATERIAL FOR PAVING CARRIED TO PORTABLE MIXERS BY INDUSTRIAL TRAINS

work. Two mixers with inclined track delivery were used to pour the main wall, 104 ft. of which was poured each day. During the time these mixers were not used for the wall they were engaged in concreting the expansion joints and cradle beams, since they could be easily disconnected from the inclined track and moved around. The incline track for each was also placed on wheels, which made it easy to move from place to place.

Pressed steel forms were used for the walls and expansion joints. These forms were satisfactory in every



PIPE CARRIED ON REINFORCED-CONCRETE CRADLES

respect, and the speed of the work was greatly increased by their use. They are also thought to have proved much cheaper than wood forms, and gave a wall that was straight and true.

The back ribs were first put in place, thus forming a frame to support the steel. The front ribs were put in position and while the concrete was being poured in the wall the plates on the incline were placed. To erect and wreck 1 lin. ft. of wall forms cost about $2.10 Two expansion joints were erected per day. These steel forms were wrecked and erected at a cost of about $17 each.

The entire cost of the reservoir will be about $296,000. In connection with the reservoir there is being constructed a rapid sand filter of about 10,000,000 gal. capacity, which will be completed during this summer. The reservoir and filtration plant combined will cost about $592,000.

The approximate quantity of concrete placed in the reservoir was 13,000 cu.yd. and 152 tons of reinforcing steel was used. Approximately 2½ tons of wire mesh reinforcing was placed in the floors.

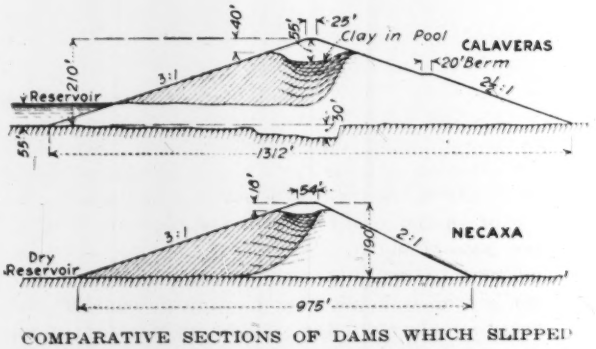
The department of public works of the City of Highland Park is carrying out the work. Lawrence Whitsit is city engineer and Mr. Hulbert is superintendent of public works. Professor W. C. Hoad and A. J. Decker, Ann Arbor, Mich., are consulting engineers, and the writer had entire charge of reservoir construction.

Two Large Earth Dam Failures Have Remarkable Similarity

Slips in the Highest Hydraulic Fill Dams at Necaxa and Calaveras Almost Identical in Dimension

ALMOST remarkable coincidence in structural behavior seems to have occurred in the failure of the Calaveras dam near San Francisco, described in this journal last week, and that of Necaxa dam No. 2, about 100 miles from the city of Mexico, a large section of which slipped into its reservoir on May 20, 1909. The Necaxa dam is the highest earth fill in the world, but will be surpassed by the Calaveras dam when that is completed. The Mexican dam was one of the last works of the late James D. Schuyler, a pioneer and great advocate of the hydraulic fill method of building earth dams. Description of its design and construction appeared a dozen years ago in a number of technical journals, but so far as can now be discovered the only record of its failure is an article in *Engineering News* of July 15, 1909, written by Mr. Schuyler a month after visiting the slide. From the data given in these articles and from data now available on the design and partial collapse of the Calaveras dam, the following figures and the accompanying sketches have been prepared.

As shown in the drawing, the sections are similar in shape, the only difference being that the Calaveras has a 1:2½ slope with a 20-ft. berm on the downstream side as compared with a 1:2 slope without berm in the case of Necaxa. Calaveras is 240 ft. from the crest to the bedrock bottom of the central ore trough and 210 ft. from crest to creek bottom, Necaxa is 190 ft. for the corresponding dimensions. Calaveras will contain slightly over 3,000,000 cu.yd. of material; Necaxa has somewhat over 2,000,000, the difference being due mainly to a longer valley in the case of the California structure. Both dams were built by the hydraulic fill method and both were of such nature as to guarantee a pure clay core section with stone gradually increasing in size up to



COMPARATIVE SECTIONS OF DAMS WHICH SLIPPED

a fairly large rock in the face. Necaxa was placed almost entirely by the hydraulic method. On the other hand, the Calaveras upstream dike was placed by mechanical means for a considerable height. Both dams had a large plastic clay core at the time of failure, the penetration by the pipe method being about the same in both cases. The reservoir at Necaxa was quite dry at the time of the dam's collapse. At Calaveras there was 55 ft. of water in the lake above the dam.

Note, then, the similarity of conditions at the time of collapse. When a third of the upstream face slipped out at Necaxa, the dike had reached an elevation of 172 ft. above stream bed. On the similar occasion at Calaveras an approximate height of 170 ft. was reached, according to the best interpretation of the figures now in hand. Necaxa had placed at that time 1,926,000 cu.yd., Calaveras 2,800,000—a practically identical percentage of 90 in both cases; 720,000 cu.yd. of earth was in the slip at Necaxa, 800,000 at Calaveras, though the gap at the former was much less in extent because the 55-ft. head in the reservoir stopped slippage below that elevation. In both cases toppling or slippage of the upstream dike first took place and through the opening thus left the mobile clay core readily slipped forward into the reservoir.

TWO EARTH DAM SLIPS

	Necaxa	Calaveras
Yardage of completed dam	2,130,000	3,085,000
Yardage in place	1,926,000	2,800,000
Percentage complete at slip	90 4	90 7
Yardage displaced by slip	720,000	800,000
Length of gap, ft	390	700
Length of dam, ft	975	1,300
Approximate height at failure, ft	172	17

There is no intention in this comparison to draw conclusions. It is given merely as an interesting coincidence. It may prove more than a coincidence in the complete investigation of the Calaveras accident which is bound to come.

Industrial City Meets War Demands in Modern Manner

Rochester, N. Y., Practically Pools Its Labor To Enable It To Perform the Services the Government Is Asking of City's Manufacturers

Reprinted From a Report of the Committee on Industrial Relations, Chamber of Commerce of the United States

ROCHESTER, N. Y., is typical of many communities upon which the Government has now made special demands for war production. In 1914 Rochester had a population of 245,000, and it had about 1300 manufacturing establishments engaged in making a variety of articles. Capital of about $130,000,000 was invested and 44,000 wage earners were employed.

Between 1914 and 1917 there had been expansion. Just how much development there had been cannot be stated with statistical accuracy, perhaps, but it included some growth in connection with contracts for European governments. The requirements placed upon Rochester by our Government since the United States entered the war have been roughly estimated at 35 per cent. additional to the normal production.

How to afford to the Government this increase in production, and to maintain the increase without interruption through discontent and unrest among workers, was the problem. It was a question of assistance to the Federal Government during a time of war. The answer was found in a coöperative undertaking among the principal employers that each would do his part in common with the rest to render the aid necessary to enable the community to perform effectively the work the Government had given it to do. When this undertaking had been elaborated all employers in the community were asked to join, and support from the labor organizations, too, was obtained.

As an agency for carrying out the general purpose a central bureau was set up, and placed in charge of a man who had successful experience with important questions of employment. This bureau operates under the supervision of an executive committee. Its expenses, together with all other costs incident to the plan, are met from a fund into which each employer paid $3 for each skilled man in his plant and 75c. for each unskilled worker. The central bureau does not displace any other agencies, such as state and federal labor exchanges; it supplements such agencies.

The bureau is the center of information. Each manufacturer began by reporting the number of skilled and unskilled workers he employed, the additional employees he would need at a future date, or the number he would release. These reports have now been developed until the requirements of the community for workers over a period of five months in the future have been accurately ascertained, and uniform labor specifications for about forty different operations in industrial plants have been elaborated; there is no chance of an employer who needs a machinist capable of highly accurate steel manipulation getting a machine-hand who can do only rough work, or of a man who is expert at mending shoe-making machinery being assigned to an employer who wants an instrument maker.

Sacrifice to the Common Need

Each manufacturer looks to the bureau for workers in accordance with the requirements of which he has given notice in advance. If he has unexpected needs, he telephones at once. If the bureau's records do not show available workers, and the need is urgent and immediate, other manufacturers unite in releasing sufficient men to meet the emergency. In other words, there is common sacrifice, if necessary, to enable the community to perform its war work.

The result of this coöperation is to utilize continuously, and without loss through temporary unemployment, the workers already in the community. These were not sufficient, however; accordingly, surveys were made of neighboring communities to ascertain if they had workers whom they could not employ. One town proved to have two hundred trained men whom it did

not need. Upon such reserves of skill the bureau proceeded to draw.

As a result of the plan, it is said that no facilities for producing materials for the Government have been idle through lack of workers, and that disorganization in the working forces of other plants has been avoided. The labor turnover during the past six months is said to have been as low as any other community ever had, even in times of peace. Instead of bidding for one another's employees, and producing general confusion and loss of production, all industries were meeting their requirements and operating in a high state of efficiency.

Such results required more than prevention of the bidding up of wages by one employer as a means of meeting his requirements at the expense of other employers in the community. It was necessary, for example, that wages be kept right. To this end a series of confidential reports from each manufacturer is used. These reports, made weekly to a member of the executive committee in charge of the central bureau, give hourly rates being paid by each plant for each class of labor, and average earnings of workers. The figures are placed in a comparative tabulation, with plants indicated by numbers, and each employer is informed only of his own number. From this tabulation each employer ascertains if he is paying a fair wage for work in the community, and he is expected to make any necessary correction in his rates; the point of view is that the community cannot afford to have any employer endanger the industrial situation by a course which will produce justifiable dissatisfaction.

Relation of Wages to Cost of Living

At the same time, there are collected all possible data showing increases in cost of living, the relation of cost of living to wages in other communities, and similar statistics. This material is kept current and is used as a basis in a sincere endeavor to have the local wage standards adjusted to the actual cost of living.

Housing, too, has had to have attention, in the sense that accommodations for workers had to be provided. The first effort has been to obtain complete utilization of existing accommodations. This has meant that many families have begun to take boarders, and frequently two families have found sufficient for both, without overcrowding, quarters which were used before by only one. At any time when more accommodations may be needed an advertising campaign may be started to persuade every householder to make available any spare room he has. In order that there might be immediate use of any house that became vacant, real estate men were asked to keep the central bureau advised.

Proper arrangement for local transportation reduces need for additional housing. In Rochester the manager of the street railways was asked to consider the number of employees who would have to be carried daily to each plant along the lines, to take into account the cars his company had at its disposal, and to arrange a "staggered" schedule of starting and closing hours for the plants so that the heaviest traffic could be "spread." Under such a plan one plant opens at seven a.m. and another on the same street railway begins work at half past seven. When the schedules had been arranged they were placed by the executive committee of the central bureau before each plant, with a direct request that it follow the hours assigned to it, as part of its assistance to the community in meeting the special demands of war. The schedules eventually arranged took into consideration the plants along different lines, and permitted the street railways to use the greater part of their cars first in one direction and then in another.

A central bureau of the kind described can serve many other useful purposes. For example, it can have a member of its staff assigned to encourage each plant to undertake to train workers for new tasks, on a new scale, that are assigned by the Government. A maker of instruments may find the Government needs instruments beyond the former capacity of his works and his employees. The material plant he can enlarge with comparative ease More men ready to perform some operations in the making of instruments may not be obtainable anywhere. It is clearly a case for training men already skilled with their hands to undertake the special work that is required. Courses for giving such training must not only be organized, but they must be maintained at high efficiency.

Employment Managers in Most Plants

In attaining success employers in a community cooperating to promote and maintain the industrial efficiency which the Government's demands require will find numerous other means adapted to their common purpose. For example, the chairman of the executive committee in charge of a central bureau may find very useful an assistant who can devote all of his time investigating independently of the bureau, complaints of employees about wages, conditions, or any other factor. At Rochester each plant is expected to have an employment manager to deal with all questions of employment and discharge, to see that so far as possible a worker is assigned to the job where he can be most efficient, and to supervise working conditions. If a plant does not have an employment manager, it is asked to designate an official with whom the central bureau can take up any question by telephone.

Whatever the concrete forms such activities may take in Rochester, they center around the common purpose of enabling the community to maintain industrial conditions that will permit it to perform the service the Government asks of its industries in a time of war. The point of view is not that the Government places war demands upon a particular manufacturer, but that it calls upon the whole community through the individual manufacturer, and that the whole community should respond in support of the war. The endeavor is to solve industrial problems before they become grave enough to interrupt essential production, and thus to lighten the burden upon the Government's own arrangements to deal with industrial disputes. The problems with which it is attempted to deal are those of the present and the period of the war.

Strawberry Reinforced-Concrete Flumes

The article entitled "Reinforced-Concrete Flumes Poured in 100-ft. Lengths," printed in *Engineering News-Record* of Mar. 21, p. 567, should have been credited to J. L. Lytel, manager of the Strawberry project, U. S. Reclamation Service, Provo, Utah.

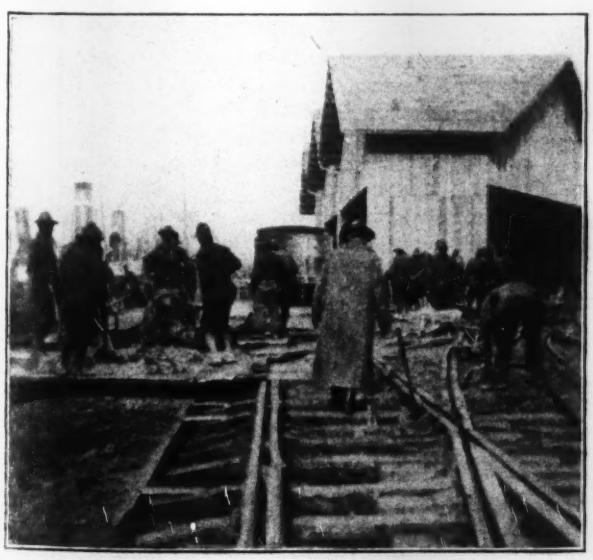
Railway Regiment Handles Jobs of All Kinds in France

Organized Primarily For Track Construction, Operation and Maintenance, the "Steenth" Engineers Have, as a Side Line, Built Dams, Hospitals, and Even Installed Plumbing Fixtures and Baking Ovens

BY ROBERT K. TOMLIN, JR.
Paris Representative of Engineering News-Record

TO KNOW that the "Steenth" Engineers are with the American Expeditionary Forces, and that they are engaged on railway construction somewhere in France, is of course a starting point for the correspondent of a technical journal who wants to send back to his paper a story on the work that these troops are doing, but it is like one of those town constable "clues" of the "ten-twenty-thirty" melodrama—a mighty elusive thing when you attempt to crystallize it into something specific. It's a "clue"—and that is about all you can say of it. For our people over here are not advertising their whereabouts or the details of the work they are doing. On the contrary, pretty definite instructions have gone out to our forces to do no promiscuous talking; so any civilian, even with the best of credentials, is apt to chase around in circles if he approaches an officer through irregular channels with such words as "where," "what," "who," "why," or any other members of the great family of interrogatives. And all this, of course, is as it should be, for enemy agents may be anywhere and any sort of information may be useful to them.

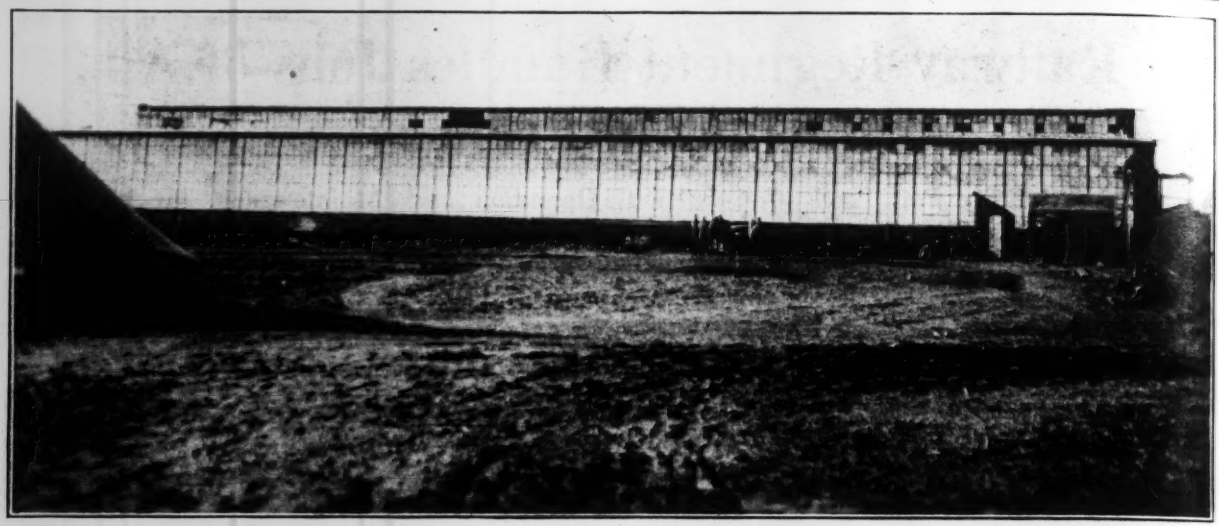
Still I had my "clue"—the "Steenth" Engineers were in France and were doing railway work—and by piecing together bits of information from here and there, I finally reached a decision as to where I thought they might be, and made plans to pay a visit to their headquarters. Now to begin with, this matter of making a railroad trip in France is not so simple as it sounds. It is by no means a case of merely choosing your destination, buying a ticket and getting aboard. You can't travel anywhere these days without a permit, and you must have mighty good reasons before any such permit is forthcoming. After being over here a while you get the impression that a very large percentage of French police and railway officialdom has been delegated to the job of asking the question "why?" But the reasons for my trip apparently were sufficient and I managed to secure my "laissez passer."



CONCRETE HAND-MIXED FOR NEW TRACK LAYOUT AT DOCKING BASIN

The selection of a train is the easiest part of the whole procedure—there is generally only one train a day to anywhere. The purchase of a railroad ticket, however, is possible only after submitting your pass to the gendarme, one of whom guards the approach to each ticket office. When this formality is completed you pass by armed guards at the gateway to the train—wondering if they too will hold you up again at the last minute—and finally you get aboard.

And so it was that I started on my quest of the "Steenth" Engineers. It was an all-day trip across flat country, and the chief item of interest en route was our passage under a veritable flock of airplanes in the vicinity of an aviation school. As our train went puffing along, planes were above us and on both sides, racing along beside our car, and cutting across the tracks ahead and behind like a school of porpoises playing alongside a ship. We reached our destination, a little town on the French coast, at dusk, and after again going through the formalities of showing passes and telling why I thought I should be so far away from Paris, I was allowed to leave the dingy railroad station and put in for the night at a ramshackle hotel, where every board on the uncarpeted floor creaked with the weight of passersby, where the electric light was just a dull, depressing glow away up in one corner of the high ceiling, and where the wind moaned down the bleak, bare corridors and through chinks in the door in fitful gusts. But in the morning things looked more cheerful. The sun, which has been a missing quantity in Paris for almost a month, broke out like an omen of good luck, and after a hurried "petit déjeuner" of chocolate and brown war bread I set forth in search of my engineer regiment. I first made inquiry of the American military police, who are stationed along all the principal streets of the little seacoast town, and ended by going for more detailed information to the local office of the American Provost Marshal. Here, after some delay in looking up records, I was informed



NEW AUTOMATIC ASSEMBLING PLANT IS STEEL FRAME STRUCTURE WITH GLASS SIDES AND MONITOR

that my goal was "Camp No. 1, about two and a half miles out of town."

My "clue" apparently was developing nicely. The "Steenth" Engineers were actually within striking distance, and in buoyant spirits I left the Provost Marshal's office in search of some conveyance which would take me to camp. In these war times transportation throughout France is badly crippled. The automobile is practically extinct, even in Paris, and the only thing available there is the taxi or fiacre. In the little seaport where I had landed the previous night I had a very clear premonition that taxis were an unknown luxury, but I went scouting about the streets until I finally located a "seagoing" hack, a brokendown affair with a cripple of a horse sagging between its shafts. It seemed like a forlorn hope, but these are not times for fastidious tastes, so I hailed the driver and managed to convey the idea that I wanted to be taken to Camp No. 1. The driver "got me" finally, and after belaboring his poor nag, which was in a sort of semi-comatose state, we got under way. It was rough going and slow. The road we took evidently had been used for heavy motor truck haulage and was pretty well broken up and rutted. However, my skipper appeared to know the channels and at last a sign with "Camp No. 1" painted on it in big black letters loomed up off our starboard bow. After making a turn to the right we were hauled up sharp by a sentry. I had my papers out of my breast pocket in a jiffy—it is surprising how practice makes this business of flashing credentials almost automatic; with me now it comes as easy as the hip-pocket motion of the Western "gunman" who is always getting the "drop" on some one.

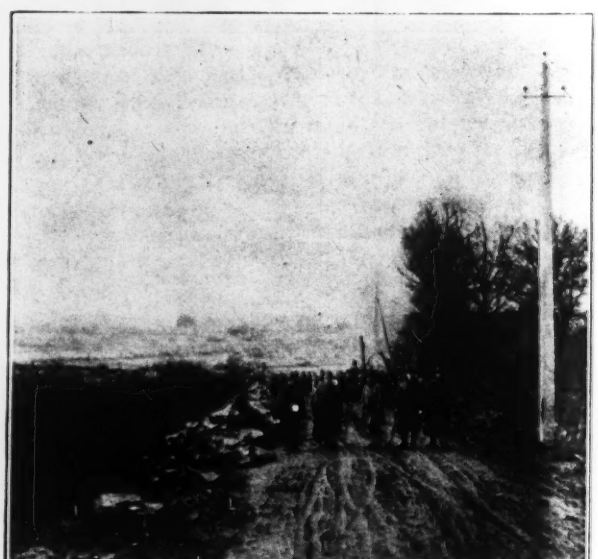
"What do you want here?" said the man in uniform, after scanning the documents which I handed him.

"I have come to see Colonel S——, of the 'Steenth' Engineers," I replied. He looked puzzled for a moment. "The 'Steenth' Engineers," he repeated; "why, they ain't here any more!"

In my early days in France this information, delivered at the end of many weary hours of travel, might have had the effect of a knockout blow, but one thing I have learned since I have been over here is that "no" sometimes means "no," and then again it may mean something else. Things are shifting rapidly. Units come and go. A man or a regiment may be here one week and hundreds of miles distant the next, so there is every reason for a poor sentry to become muddled in his knowledge of the location of troops even in his own camp. At any rate, I did not intend to give up my "clue" without a fight.

"You must be mistaken," I said to the man who barred my road, although the conviction I tried to throw into the words had very little solid foundation to rest upon. "I know that the 'Steenth' Engineers are here and I have an important message to deliver to the Colonel."

"Wait a minute," said the sentry, and he marched off to confer with a non-commissioned officer of the guard. While this parley was in progress a captain



RIPRAP AT ROADSIDE WAITING FOR TRANSPORT TO EARTH DAM

walked by and to my delight I saw the castle insignia of the engineers on his collar band.

"Captain," I shouted, "can you tell me how to reach Colonel S—— of the 'Steenth' Engineers?"

"Certainly," replied the officer, "his headquarters are right over there. I'm going there myself; come along." Never did more heartening words pass the lips of any man than those which I had just heard. With a wave to my sentry, who came to the present arms as I passed him with my Heaven-sent convoy, and a signal to my cabby to let go anchor—an unnecessary detail, as both he and his horse had passed away by this time—I climbed up a steep bank from the roadside, and there, about a hundred yards away was a long low wooden shack with a sign bearing the magic words "Headquarters, 'Steenth' Engineers." I had reached port at last!

Headquarters was a busy place. Typewriters were clicking away noisily. Uniformed men were bent over drafting boards. Others were engaged, apparently, in computing work. A group of surveying instruments was stacked in one corner of the room, and a first sergeant, coatless, with sleeves rolled up elbow high, was busy with a batch of reports which he was filling out on a sort of combination desk and military trunk. To him I presented my card and was soon escorted to the Colonel's private room. The Colonel had left town, I was informed, but Major A——, in command of the unit during his absence, gave me a hearty greeting.

Now the "Steenth" Engineers is one of the so called "Railway Regiments" which were recruited with volunteers early in the war, and were among the first American troops to arrive in France. This particular unit is made up very largely, although not exclusively, of men from the South. About 1200 strong when it left the states, it has grown in numbers, principally by the addition of labor battalions, until its quota is now several thousand men. Its operations cover a territory about 210 miles long and 150 miles wide, and its work has included pretty nearly everything from the actual laying of railroad track to the installation of a baking oven and shower-baths in one of the base hospitals.

The immediate big task of the "Steenth" Engineers, however, is the development of ocean and railway terminal facilities at the French seaport near its main camp. This problem was outlined briefly in a former article (see *Engineering News-Record*, p. 348, Feb. 21, 1918). The job consists essentially in rearranging the track system which serves the docking basins and in providing an immense new freight classification and storage yard on the flat lands which flank the waterfront. There are projected also four new steamship piers, each 1000 ft. long, with the necessary unloading equipment and trackage to hook them up to the freight classification yard and storehouses. These new piers, which will have a 30 ft. depth of water, will have a docking capacity sufficient for 16 ships at one time.

THIRTY-THOUSAND YARD EARTH DAM AT FRENCH SEAPORT BUILT WITH PICK AND SHOVEL

Work on the big railway yard is now in progress. The job is essentially one of track laying and very light grading as the ground is practically flat. Steam shovels are at work in a borrow pit delivering sand for track ballast, as this material, it has been found, will answer the purpose well enough; crushed rock is a very difficult commodity to secure. At the time of my visit on Marion steam shovel was in operation and two large Bucyrus and one Marion machine were being set up. Other equipment included half a dozen locomotive cranes of from 5 to 10 tons capacity. The installation of the trackage in the railway yards is calling for a sand fill of about a foot or so over the entire area. But the tracks are, of course, only part of the project. There will be 4,000,000 sq.ft. of covered freight storage structures and about 9,000,00 sq.ft. of uncovered storage area. Steel for some of the these buildings is on the ground and I saw a few of the bents in course of erection. All connections are bolted, as there are no facilities here for riveting.

At the existing docks American labor units and

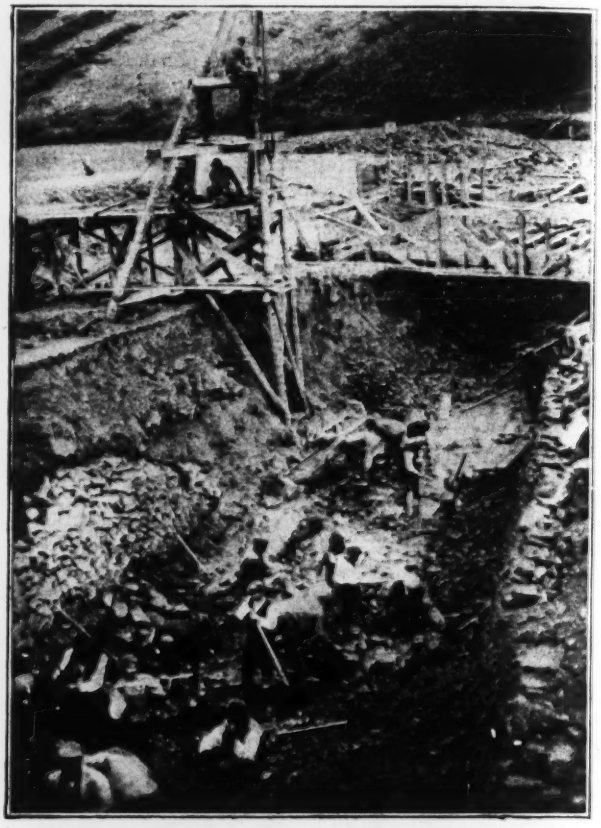
gangs of German prisoners were rearranging the trackage system and replacing the French turntables, which are too short for American rolling stock, with curved track and switches. A small amount of concrete was being placed between the rails, but all of this was hard work, the mixing being done in small batches on wooden platforms which were moved about from place to place as occasion demanded. Lack of construction plant is, of course, responsible for so large a use of hand labor methods. The engineers, however, are on the lookout for mechanical equipment, and have scouts in various parts of Europe whose job is to corral anything that can be shipped quickly to the work. One of the officers of the "Steenth" Engineers who has had wide experience in the purchase of supplies got news of a big steam shovel in Spain which had been used on some hydro-electric construction work in that country. Agents were dispatched to round up this excavator and through their quick action it was purchased, delivered, and set to work digging sand for track ballast. In like manner quite a sizable consignment of railroad ties from Portugal was secured. Anything of this sort that can be done to reduce the demands on transatlantic shipping is considered good business.

While the railway yards and docks are engaging a portion of the strength of the "Steenth" Engineers there are scores of other jobs which the organization has been called upon to do. "Although we are, in name, a 'railway regiment'," Major A—— explained, "we have tackled about every sort of job which you can imagine since we landed in France. Let me give you an idea of the variety of our program. At two nearby towns we are building hospitals, sewerage systems and dams for water-supply, and are assisting in the double tracking of one of the French main line routes through another town. At another place we will soon begin construction on a division engine terminal, an overhead railroad crossing, and a yard for car erection. Additions to hospitals in the form of one-story timber structures have taken up a large part of our time. At one large base hospital we are putting in a new water-supply system which involves the construction of a curved concrete dam about 40 ft. high. For supplying water to the town near our camp we have almost finished an earth dam containing about 30,000 cu.yd. of material. The laying of 15 miles of 16 in. pipe, the reconstruction of a water-filtration plant and the provision of Imhoff tanks for sewage disposal are other details of our work."

"How about the German royalties on the Imhoff tank patents, Major?" I interrupted.

"Let them come over and collect them," was the Major's reply.

I spent the afternoon in an automobile trip, inspecting features of the regiment's varied work. The earth dam was well along toward completion, but it, like most of the other jobs, had been a hand labor proposition. Shovels, wheelbarrows, and a line of narrow-gage industrial track and cars constituted the main items of plant equipment. At the concrete dam the work was in its initial stages and the main operation at the time of my visit was rock excavation for the cutoff wall. This job has been let by the Army to a Mexican contractor. Rock drilling was as usual being done with hand tools, although on this job I saw two concrete mixers, the first machines of their kind which have come under my observation since I have been in France. Another job we passed by was a steel frame structure which was being built for the assembly and repair of motor trucks and automobiles.



HAND DRILLING IN CUTOFF TRENCH FOR CONCRETE DAM

This, then, is a sketch of the work which a "railway regiment" has done and is planning to do. But the important thing about it all is this fact: No matter how diversified have been the demands upon them, the "Steenth" Engineers have been able to produce from their organization men qualified to handle every one of the scores of different jobs assigned to them.

To Avoid Brittleness in Plated Springs

In two papers, by John Coulson and G. S. Fuller, presented at the recent meeting of the American Electrochemical Society, the effect of absorbed hydrogen on the brittleness of steel and iron products was discussed. Mr. Coulson paid particular attention to the embrittling action of electrolytic pickling, and Mr. Fuller gave the results of his investigations of methods of preventing brittleness in springs which were to be electroplated. Both papers proved fully that nascent hydrogen, evolved in the process of pickling or in electroplating, produced brittleness which in some cases resulted in a virtually worthless article. Mr. Fuller found that if springs were tinned the coating thus produced was impervious to the hydrogen iron and that the resulting springs retained all the physical qualities of the original sample.

"Plant Department" Can Make Large Savings on Construction Equipment

Modern Methods of Assembling and Recording the Movements of Plant—Standardization an Important Factor

By Thomas A. Brady
Plant Department, the Snare & Triest Co., Newark, N. J.

FIFTEEN years' experience in charge of contractors' plant has convinced the writer of the general need for systematizing the purchase, storage, repair and shipment of all construction equipment and supplies. While some of the principles outlined may be familiar to big contractors' organizations, the writer believes that only the detailed working out of the methods will give best results in economy of time and money. Briefly outlined the plan involves the centralizing in a "plant department" the control of selection, repair and movements of all plant, tools and parts. The selection of standardized equipment is recommended. Complete listing of all plant permits the speedy dispatch of equipment and tools from job to job and a reduction in the number of idle machines. Let us see how these principles work out in practice.

As soon as the contract has been awarded, the question comes as to when the work will be started and what plant is available. A superintendent is employed who, so far as the contractor can ascertain, is the best man he can get for the class of work to be performed. This man generally has his own idea as to how the work is to be accomplished and he selects his own plant. When you take his selection and the selection of ten other superintendents on similar work you will seldom find two of them alike. As a result the contractor has an enormous supply of plant on his hands, most of which eventually is sold as scrap.

To avoid this the contractor should employ an experienced plant man to handle this end of the work, who will be capable of selecting the tools and machinery required. In order to avoid any misunderstandings the plant man should coöperate with the chief engineer and superintendent in charge of the job and all three should work with the one object in view—that of completing the work at the least possible expense to the contractor.

Planning the Plant

When the contract is awarded these three men should go over the site of the work and plan, so far as possible, each step of the proposed job. After they have decided on the most economical method of doing the work, a plan should be drawn showing the location of the various machines, derricks, storeroom, office, and workmen's quarters. Give the possible date as to when each separate step of the work is to be completed. This will enable the plant department to get the items on the job when they are required and will save considerable expense for moving surplus plant. Equipment not required by the job can be used on other work.

As soon as each large section of the work is completed the equipment not needed on any other part of the job should be returned to the plant department for use elsewhere. The shipping of plant between contracts should be under the supervision of the plant man.

The large plant in use on the work such as engines, compressors, motors, concrete mixers, derricks, etc., should all be standardized. By this method the saving will be considerable in all branches of the work. If there is a breakdown caused by some of the parts of machines wearing out, the superintendent can immediately telegraph or telephone the plant department, giving the code number of machine and name of part broken. He is sure of getting the needed part right out of stock, as it is easy and inexpensive to carry a supply of all the wearing parts of the various machines, as long as they are of the same make.

If the job is too far away from plant department headquarters to permit quick shipment of parts, a supply of wearing parts should be kept on the job. If the contractor does not want to carry these parts, any maker of machines, knowing that the contractor is using his make of equipment as the standard, would gladly carry a supply of parts in his nearest warehouse to be shipped on the contractor's order at a moment's notice.

Economy in Standardizing

All steel derricks of capacities above 5-ton should be built in three sizes, in 10, 20 and 30-ton capacities, made to the contractor's own specifications. All parts except the boom of each size derrick should be interchangeable, the boom to be made to suit standard derricks in sectional form for adding or lessening the length.

The savings in plant repair by using standardized equipment are considerable, as the mechanics familiarize themselves with the machines and turn out their work in half the time required on other jobs where they encounter every make and type of equipment.

The chief engineer should check carefully the kind of power to be used on the work, whether steam, electric or gasoline. He should also check the best methods of getting material to the site, such as trucking, boat hire or railroad. Railroad is the cheapest in most cases; the only handicap is the delay in getting material on time. This can be avoided by giving the plant department ample time to ship.

Listing Tools and Supplies

The next question that arises is the subject of small tools and supplies. When making up this list for the work, items generally are jotted down as they come to the minds of the superintendent and plant man. No matter how well they are acquainted with small tool requirements it is impossible to remember all tools needed for the work. This means that after the work is started the superintendent suddenly discovers that something is missing and sends in a hurry call to plant department or buys the tools locally at high expense and considerable loss of time on the work. When these omissions happen a dozen or more times the contractor is paying the price of inefficient methods.

The best method of helping the superintendent on this question is to make up a printed list in alphabetical form, showing the name and size of any article or tool that possibly can be used for the class of work that the contractor performs. This list should be in loose-leaf form, letter size. It should show for the superintendent's information the maximum and minimum amount of each item carried in plant stock. Columns should be provided to show the quantity required and quantity re-

turned after completion of the work. Small tool losses on the job are thus shown at a glance, and if there is any great discrepancy the question of losses can be adjusted at once. If the losses are within reason, it will help the estimator on similar work to calculate his small tool costs. The plant department should report the repair costs of tools returned, this to be added to losses. This checking also will enable the contractor to guard against these losses on the next job.

Makers of construction equipment and tools should be asked to submit a duplicate-part sheet showing numbers and names of parts, with pictures of machines showing these markings at the top of the sheet. These sheets may be reprinted by the contractor and made to conform to the loose-leaf letter size for posting with his small tool list. The contractor's own make of machines and derricks may be made up in the same form. This information will be of great help on the job when ordering parts.

In addition to the tool list a workman's "kit list" should be made up in loose-leaf form. Each workman's kit should be listed complete, with a notation showing what the employer furnishes and what the workman furnishes. These kit lists should cover all complete outfits for a given number of men for various classes of the work, such as: blacksmith's kit, camp kit, commissary kit, erection kit, pile-driving kit, engineers' kit and all others according to the nature of the contractor's work.

All of the tools and supplies in these kits will show in the small and large tool list and are only used to check up quickly the kits for each class of work. When this is determined the total number required of each tool or machine is placed in the "quantity-required" column.

The plant department will make up a list in triplicate, one copy to be kept on file at the plant department, one for use on the job and one for the manager's use when planning other work. These lists will show him what plant he has available on the different jobs and at the plant department.

The storekeepers at the plant department and on the job may lay out their storerooms, each using a copy of the plant list as an index for his supplies. Sections and bins in each part of the storeroom are numbered and these numbers are indicated in the list opposite each item. A plan of the layout is drawn on a loose-leaf sheet and posted in the binder. In case the storekeeper is absent, it is then easy for anyone to locate material in the storeroom.

The purchasing agent will find this list useful for keeping prices of machines, machine parts and tools in an up-to-date manner without much additional labor. One set of sheets would answer for one year's prices arranged monthly. He can also index the firms with whom he does business by a number code and use this list for placing of orders.

The bookkeeping department, by having a copy of purchasing agent's prices, can check invoices readily and the annual inventory of tools and machinery can be quickly made.

The contractor who has not standardized on plant and who has a large stock of equipment on hand may object to this plan as impracticable. It will pay him to check up his plant and list the old equipment, establishing a "detention pen" for the storage of old machines that are near the graveyard stage of their career. These machines may be sold, by auction if necessary.

The small tool question should be adjusted in the same way, only if there is a quantity of tools of the old style that can be altered to suit the new standard, at a cost lower than that of new tools, this should be done.

The initial cost of the printing of these lists and the time spent in making them up should not stop the contractor from taking this step, as they certainly will repay him if the method described is followed out to the letter.

Irrigate Roads To Make Them Hard

ON THE silty bottom areas of the Colorado River near Yuma, Ariz., moist earth packs readily and makes a dustless road for several weeks. To effect this result the irrigating ditches along the roads are tapped and the roads flooded. This is not done, however, until the dust has been smoothed down by a mouldboard scraper. As it is essential that the traffic be kept off until the excess water has disappeared and the silt has begun to bake, it is customary to flood half of the width of the road at a time. The unusual industry of the Indian leveling off the dust in the hazy photograph was no doubt due to his unwillingness to face the camera of the representative of *Engineering News-Record*.

SCRAPER LEVELS DUST BEFORE IRRIGATION OF ROAD

DOUBLE-TRACK ROADS BANKED TO RETAIN WATER

How Freight-Handling Machinery Is Being Used Abroad

For Trans-shipment at Ports and for Warehouse Movements the Lack of Labor in the War Zone Leads to the Application of Mechanical Aids

By Harry Varndell
Rownson, Drew & Clydesdale, Ltd., New York City.

LABOR in Europe is scarce—not merely high priced as it is today in this country, but difficult to get at any price. Every labor saving device possible must therefore be put into service in every line of activity, and freight handling is no exception to the rule. For the loading and unloading of ships, and for the many movements of material in and around factories, the war has brought a great increase in the use of machinery. Many of the machines now in use there are not new, many, in fact, are in infrequent service in the United States, but the growing use under the war conditions in Europe and particularly in England should be known to American engineers.

Next to the building of ships the most vital factor in conserving tonnage is to use the available ships to their utmost capacity. Delays due to poor loading and unloading facilities considerably reduce the number of sailings of each boat. It is estimated that in the ordinary course a boat averages about 200 days at sea, about 150 days in dock loading and unloading cargo and about 15 days undergoing repairs. From these figures it is readily seen that, with the limited ship space available, together with the exorbitant demands thereon, any method or methods whereby each boat can materially lessen its days in port and thus increase its days in serviceable use is an extremely valuable asset in relieving the shipping situation.

Many ways and means of hastening the process are available, but the necessity now arises for methods which accomplish this end and simultaneously reduce to a minimum the amount of human labor employed. Throughout ports of England and of France is now to be seen a very perfect method of handling ships' cargoes. Between the French ports and the firing line miles of gravity and other conveyors are in constant use, and are indeed serving their purpose to an extent far beyond the dreams of their makers.

A recent successful machine for handling general ships' cargo, i.e., cases of tea, bully beef, biscuits, fruit, boxes, bales, bags, etc., is the portable elevator shown in the views. As its name implies, this elevator is of true portability. The ability to use an elevator capable of unloading tons of material an hour, in one place today and in a totally different place tomorrow, cannot be overestimated from a utility and economic point of view. Its construction consists of a steel frame of a width and length determined respectively by dimensions of cargo and beam of ship. Along both sides at the top of the frame are chains which run over sprocket wheels at each end and which drop to the depth required. At regular intervals along each chain and opposite each other are special links to which are attached crossbars. From each of these crossbars is hung a heavy canvas sling which is fastened at the bottom to the next crossbar, allowance being made for the canvas to hang in the position of a pocket or sling. These slings serve as the carriers. The whole contrivance is thus represented by two parallel strands of chain which when revolving on the sprocket wheels present an unending vista of canvas slings.

When in use on the boat the machine takes up small space in the hatchway and does not interfere with the working of the ship derricks hoisting or lowering the very heavy and bulky cargo. It is hoisted onto the boat

STACKER USED IN ENGLAND TO LOAD WAGONS

in a collapsed state. The elevator is then placed in position with one of the terminals immediately in position to drop into the hold, while the other extends over the ship's side onto the quay, or to the barge which may be delivering the cargo. The receiving terminal is lowered into position on the quay or barge with balance weight attached, and the delivery terminal is lowered at the desired spot of discharge in the ship's hold.

The speed at which this elevator works is about 60 ft. per min. The pitch of the slings or receptacles vary from 2 ft. 6 in. to 4 ft. according to the variety of cargo to be handled. Fluctuation of tide and the different depths of boat holds are obviated by a take-up, the action of which is to take in or pay out to the required depth the chains to which the slings are attached by

CASES ARE AUTOMATICALLY DISCHARGED ONTO ROLLERS IN HOLD OF VESSEL

WHARF END OF CARRIER TAKES CASES

crossbars. Thus when the terminals are in use at shallow depth the unrequired chain and slings are taken up in the entire length of the top frame.

In one of the views herewith is shown the receiving terminal in position. This is maintained by the balance weight holding the chains taut. The cargo is here pushed into the slings, one article, crate, bag, or whatever is being handled, to each sling. On arriving at discharge point the bottom of each sling encounters a small arm, or tripper, which, combined with the descending movement of the sling, has the effect of pushing the sling's contents outward onto the discharge table, where they are dealt with according to requirements. In many cases the goods are discharged immediately onto a belt conveyor or to gravity carriers.

In the wartime factories and warehouses of Europe mechanical handling devices are being multiplied. Two widely used types will be described.

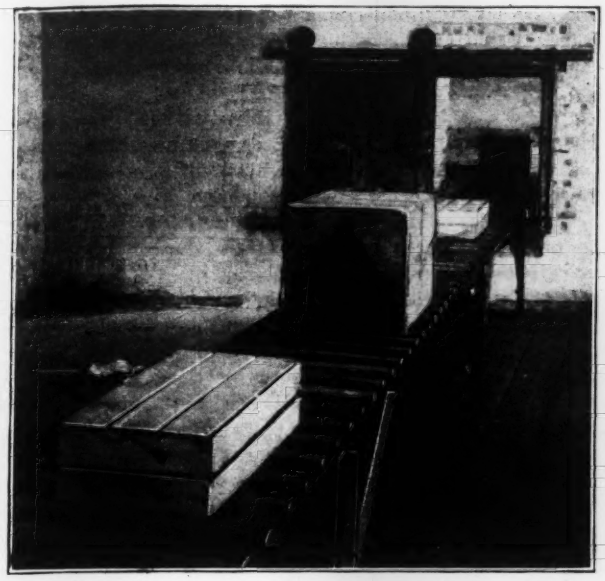
One of the views shows a sketch of a gravity roller carrier in use. Simplicity is evident in its construction, which consists of frame of angle iron with parallel sides, with rollers fitted across on spindles at regular intervals. Boxes, cases, etc., are merely placed on the carrier and allowed to move forward by gravity, the conveyor being set at sufficient gradient according to speed at which the goods are to travel. The rollers are hollow steel tubes of No. 16 gage and 2 in. diameter and are fitted with steel ends which contain the bearings. Either ball bearings or roller bearings are used. Roller bearings undoubtedly will stand harder use and have longer life, as the weight of the freight in transit is taken evenly along the surface of the rollers. In the case of ball bearings there is a very small surface to take the strain, and consequently these give way earlier.

The conveyor is made in standard lengths with joining links, and bends or curves to enable the material to turn corners. To permit of true portability and general utility each length of conveyor should be 8 ft., this length having now been standardized. All that is necessary when the conveyor is required for use is to connect up the links until the conveyor is suitably long, resting it on any old boxes available, or if for a permanency, on trestles. After use it is only the work of a few minutes to disconnect the lengths and stand them up in an odd corner.

At the point where the gradient brings the gravity carrier down to ground level it is necessary, when the goods are required to travel further, to regain elevation to permit of further movement. This is obtained by a small low-powered machine called a booster. This can either be on the principle of a belt conveyor or of traveling chains with suitable attachments to pick up the material and raise it to the head of the next stretch of gravity conveyor, upon which it smoothly pushes its burden, which now again moves forward by gravity. This process can be repeated almost indefinitely.

In cases where only the stacking or tiering of bags, boxes or bales is required, stacking machines after the principle of that illustrated in one of the views are being used. The material is either automatically discharged from gravity or other carriers onto a small platform at the foot of the stacker or placed there by hand and is engaged by a slat or other attachment on the endless belt or chain. The stacker illustrated in this view is of the endless belt pattern, with wooden bars or slats riveted across at intervals to prevent the material from slipping down the belt. With a machine of this description it is unwise to attempt to stack material at a steeper angle than 45°, beyond which the force of gravity causes the goods to topple backward. Where material is required to be tiered at a steeper angle other patterns of stackers, depending on the type of material, are employed. Variation of elevation of the stacker is obtained by means of a small winch on the stacker carriage.

These machines are electrically operated and require



GRAVITY CARRIER HANDLES BOXES IN WAR FACTORY

about ½ to 3 hp. motor, depending again of course upon the weight to be handled and the speed required.

Stacking machines such as this are used for a wide variety of goods, and are especially useful in a modified form for handling barrels and crates. When used beyond the angle of 45° the proposition really assumes more of the nature of an elevator. In such cases where the elevator is used for barrels it is merely an upright steel structure with sprocket wheels at top and bottom and around which pass the chains, to which are attached the arms for holding the barrels. It can either be electrically operated or connected by pulley to existing shafting. Power is brought direct to the top sprocket, and is thus concentrated on the upward motion of the chain. Approximately only half of the chain is subject to power at any one time and it is this part of the chain that really does the work. The arms of the elevator may be straight and at right angles to the chain or convex-shaped and pivoted at the points of support on the chain. This latter type is necessary where the discharge of the barrels is to take place on more than one floor.

The point or points at which the arms receive the barrels is prepared by merely cutting slits in the floor or platform to permit passage of the arms. Barrels are rolled up close to the chains and are taken up as the arms rise through the floor or platform. By this method the loading and unloading can be accomplished at any floor.

Contractor Analyzes Overhead from Five-Year Records

OVERHEAD is the deceptive part of a contractor's costs on a sewer contract. So stated Stanley D. Moore, president of the Moore-Seig Construction Co., Waterloo, Ia., at the recent meeting of the Iowa Engineering Society. Less than 10% of the contractors of the country are successful or even solvent, in his opinion. Further notes from his paper follow: "In this age of production we have kept our eyes only on the lessened cost of the actual operation and have forgotten that much of this saving is taken up in overhead charges that did not exist formerly. The unit basis for moving earth by hand may be 25 cents per yard. The same operation by machine may be performed for 10 cents per yard, but the overhead charges on the machine may equal, if not exceed the 15 cents saved. The only advantage of the machine is a gain in time and escape from labor shortage."

An analysis of overhead charges, taken from records of Mr. Moore's company over a period of five years, represent $500,000 worth of sewer work. It was done in better than average soil, at better than average price, handled with better than average efficiency by a well-equipped, well-financed and well-organized concern. Figures for 1917 were omitted purposely because of the unusual conditions under which the firm sustained a loss.

Contract prices in this analysis were distributed as follows: profit, 1.6%; overhead, 18.4%; material, 18.0%; and labor, 62.0%.

In the table, job expense includes freight on tools, drayage, transportation, straight time men, bunk houses and storage. In the consumed material item are such things as lumber, jute, dynamite, coal, gasoline, kerosene, cement bags and boots.

Figured on the basis of net instead of gross cost the 24% becomes 31.7% and to yield 10% on one's money the total bid should be 146.4% of the net cost made up of net cost 100%, overhead 31.7%; and profit 14.7%. To yield 15% the overhead is the same, 31.7%; but profit is raised to 22.8%, making the total bid 154.5%.

SEGREGATED OVERHEAD CHARGES

Item	Five-Yr. Average 1911–16	Estimate for 1918	Item	Five-Yr. Average 1911–16	Estimate for 1918
Job expense	1.4%	1.7%	Dues contractors' association	1.8%	1.8%
Maintenance	0.6	0.6	Office expense	0.6	0.7
Plant repairs	1.5	1.8	Salaries	2.3	2.3
Small tools	1.1	1.3	Traveling	1.3	1.5
Depreciation	1.0	2.0	War tax	...	0.5
Consumed material	2.4	2.4	Interest on investment	...	0.5
Bonds	0.7	1.7		18.4%	24.0%
Insurance	1.6	1.9			
Interest	1.1	1.3			
Discount	1.0	2.0			

The items of cost for which money was actually paid out compared with those for which the engineer usually allows are listed as follows: Engineer's costs usually cover only sewer pipe, bonds, insurance, labor, discount and association dues, but he forgets, said Mr. Moore, jute, city councils' special requests, cement, tools, inefficiency, depreciation, interest, errors, salaries, bad work, attorney's fees, taxes, transportion, engineer's errors, engineer's delays, engineer's estimate, maintenance, bad weather, freight on tools, straight time, storage, lumber, repairs, shipping delays, office expense, manholes, drayage, bad luck, traveling expense, water pipe and gas mains.

Finally, said Mr. Moore, there has been too much secrecy on the part of the contractor, too little information given by the engineer and too much suspicion on the part of the communities, also a regrettable lack of consideration of the rights of the contractor by engineers. Both engineers and contractors guess too much.

Timber Derrick Gantry Crane For Ship Erection

Gantry Straddling Track Between Shipways Carries Single Derrick—Timber Gives Weight for Stability at Low Cost

By Max J. Welch
Hollingsworth Building, Los Angeles, Calif.

PRESENT time high-speed ship construction calls for erection cranes of special design. One form of these, which has been doing successful work, is the timber derrick gantry used at one of the prominent wooden-ship plants. This crane is particularly worth note, in spite of its simplicity, because it was so worked out as to permit of rapid construction from standard materials that could be procured readily.

The high-speed shipyards all have a number of shipways side by side, on which the ships are erected. Commonly, the ways are built by driving wood or concrete piling into the ground and capping and planking the top of the piling to make a platform sloping toward the bay, on which the shell of the ship is built, stern toward the water, and from which it is launched. The ways may have a slope of ⅝ in. to 1 in. per foot; some shipbuilders prefer more slope than others.

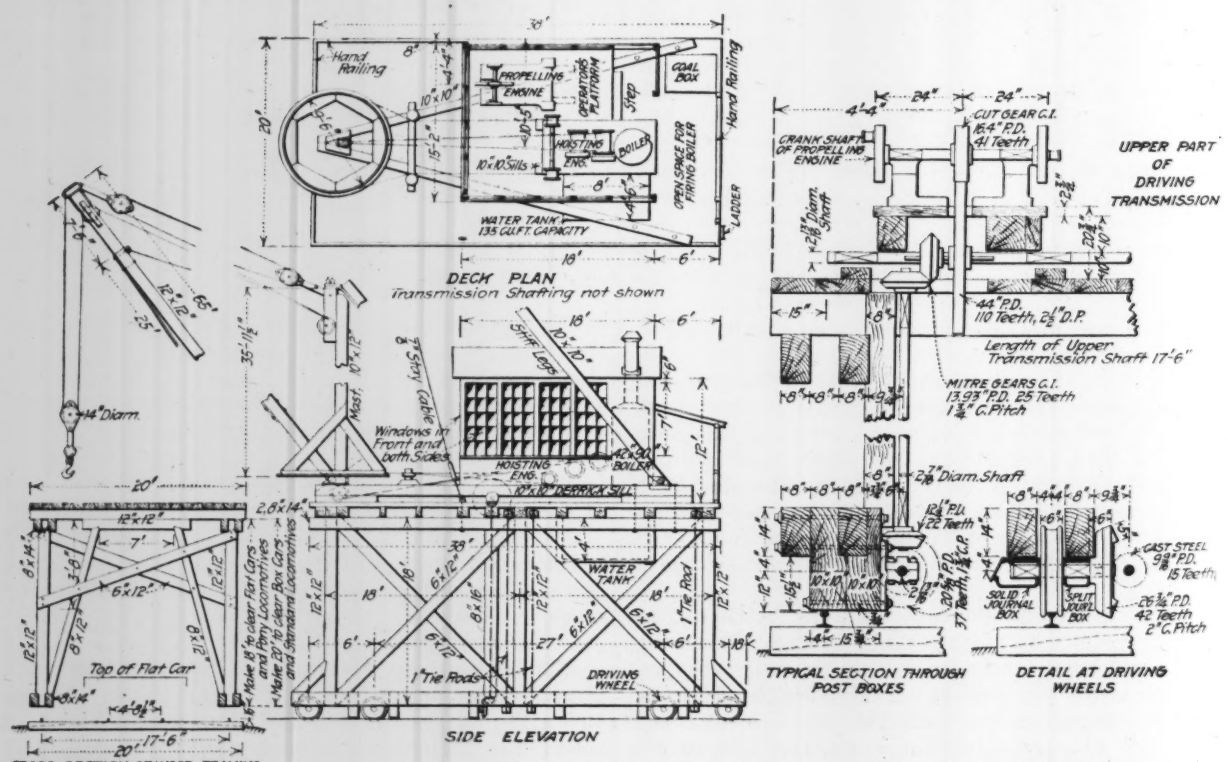
The spacing of adjacent ways set in the center is fixed to suit the size of ships to be constructed. At the particular shipyard in question the spacing ranges from 77 to 95 ft. This leaves a narrow space between the ships that are being erected that is not adequate for storing and handling the material that is to go into the ship. It is the duty of the gantry crane to pick up this material from a point back of the ways, and carry it down between the ways to a proper location, then swing the material around to one side and over the ship.

In the new type of wooden ships brought into prominence by the war the chief assembling item is the crossframe. Such a frame is built up of a number of pieces of wood, each sawed to shape, pinned together by treenails. One assembled crossframe may weigh as much as ten tons. The crane shown has a safe margin over this maximum.

While the derrick gantry is not a new type, its adaptation to shipbuilding is a novelty. Under the old method of ship construction, with housed-in ways, there was provided a row of high columns between the ways, on which bridge cranes traveled back and forth over the ship, handling material to its place. The derrick gantry as used here is an excellent type of machine where the climatic conditions permit much work in the open. No high buildings are required, and the space between ways is kept clear at all times for handling bulky material. A railway track may be built between the ways, the crane saddling it. Finally, the crane is one that can be built quickly and is of minimum cost.

The selection of wood as material for the main part of the cranes was dictated primarily by the desire for quick construction. In addition there was a gain in stability against overturning, as compared with steel. We look upon wood as being a light material, but when cost is taken into consideration the argument is in favor of the wood. The wood in this crane costs 1½c. per lb., framed in place.

The greatest load which the gantry crane will lift,



TEN-TON DERRICK GANTRY BUILT OF STOCK MATERIAL AND EQUIPMENT FOR SHIP ERECTION

when the boom is swung at right angles to the track, and the crane hook is 40 ft. from the center of the mast, is a little over 14 tons. Its working capacity, fixed at 10 tons, leaves a margin of about 4 tons.

The approximate total weight of the entire gantry crane is as follows:

	Pounds
Operator's house	8,500
Stiffleg derrick, complete	16,600
Hoisting engine	14,000
Propelling engine	3,400
Wheels, gears, shafting	7,200
Bolts, tie-rods, nuts	1,600
Woodwork (except derrick and water tank)	57,050
Water tank, half filled	5,392
Total	113,742

The bracing of the gantry was designed with regard to all the various conditions of working of the crane. The heavy plank floor not only provides a foundation for the machinery but acts as horizontal bracing to take up the twisting strains which exist when the load is swung from side to side, and distributes them to the entire supporting structure of the gantry. The diagonal cross-bracing must be heavy enough so that when the crane load is applied at one end of the structure the overturning effect will be transmitted to the whole length of the gantry and utilize the weight of the hoisting engine to prevent the gantry from tipping over.

The strains which develop in the stifflegs of the derrick are much greater when the stifflegs are set at an acute angle than when set at 90°. As designed they are adequate for the service required. They are supplemented, however, by two stay cables fitted with turnbuckles, which pass from the masthead to the side of the platform at about mid-length.

The water tank, placed under the deck and to one side, is of such size and distance from the center that it just counterbalances the propelling engine. The effect is that the gantry has exactly the same resistance to overturning to right or left, and therefore has equal lifting capacity and equal safety.

Steam power was decided on for several reasons. Steam is reliable, is independent of live wires between shipways, and is elastic in starting and stopping heavy loads with minimum shock to the transmission machinery; and, what is more important than anything else, the necessary equipment could be purchased in the shortest possible time.

The main hoisting engine is a 7½ x 10-in. reversing type, with three shafts. One drum handles the load line, another the boom falls, and a pair of drums on the forward shaft swing the boom. The propelling engine, which drives the crane up and down between the ways is 7 x 10-in. two-cylinder reversing, the crankshaft being geared direct to the upper transmission shafting. The arrangement of the engines is such that the operator can reach any lever from one position, and all machinery is in view and readily accessible.

The propelling transmission system consists of a top horizontal shaft, two vertical shafts and two lower longitudinal shafts, with the necessary bevel gears, journal boxes, etc., to make a complete working unit. Four of the eight wheels are driven. At 200 r.p.m. engine speed the gantry travels 100 ft. per min. Detail sketches show some of the most important items in the transmission. The transmission shafting is fastened to the frame timbers in a particularly simple manner. Rigid boxes are used throughout. Great care was taken in construction to align the shafting perfectly.

This type of gantry crane is not limited to the construction of wooden ships. It can be used equally well for steel ship work. Other arrangements of crane are possible. Similar machines have been built with two derricks, one serving one ship, and the other serving the opposite. The one shown herewith probably represents the maximum combination of simplicity, universal adaptability, low cost and quick construction.

Engineer Gives Views on Increasing Food Production

MUCH meritorious effort is being exerted toward getting settlers on the reclamation projects in the arid west for which water is now available. For quick action and early results, however, intensive work to stimulate food production in the Middle West will probably give a far larger return from a given investment.

That this is a subject with which the engineer must concern himself was recently set forth most clearly by Harrison B. Riley, president of the Chicago Title & Trust Co. He quotes a prominent consulting engineer, who has constructed and operated successful drainage projects in the Mississippi Valley, as follows: "It would seem that in view of the urgent demands for the production of more foodstuffs in the United States, the most effective results would be obtained by making available to farmers in the central West or upper Mississippi Valley the funds and labor needful to plant and cultivate in a thorough manner the largest possible acreage. This applies also to large areas of rich alluvial lands in the central Southern States—Arkansas, Mississippi, Louisiana and eastern Texas.

"There are great areas of land in both these sections which are now only partially productive for lack of capital and labor. There are plenty of men who are thoroughly familiar with the agricultural methods of this great region who, if they were aided with capital, would gladly give their attention to agriculture instead of working in the cities in shops and factories, because the cities have been largely recruited in recent years with men and women from the farms. Many, probably a majority, of these men and women who have gone from the farms to the cities are earning only a bare living and have not enough savings to enable them to take up farming on their own account.

"This is a far different problem from that of teaching to large numbers of colonized settlers the methods of successful farming in the irrigated and dry farming areas of the arid West. Probably few realize that the great Mississippi Valley would produce at least 50% greater average crop yield if the methods and labor of cultivation were brought to such a standard as would be possible with proper financing and intelligent supervision, such as has been ably and successfully started by the Federal Government in the County farm adviser system. Further, there are large tracts recently reclaimed by drainage and protection from overflow that are not now producing crops owing to lack of capital and immediately available labor. If the land in these drainage reclamation projects were made productive it is probable that the output from these areas could immediately be doubled.

Uniform Methods of Road Construction Accounting Desirable

Variety of Systems Now in Use Makes Comparisons of Cost Practically Impossible—Items Should Be Separated According to the Nature of the Operation—Equipment and Perishable Tools Account

By Edward N. Hines

Chairman, Board of Road Commissioners, Wayne County, Michigan

THE remarkably rapid development in road building in this country in the last decade has resulted in one phase of the work not being given the attention its importance really warrants. This reference is to the feature of cost accounting as applied to both construction and maintenance in road construction. The crying need for a simple yet comprehensive plan of cost determination suitable for standard use among road builders has not been fully appreciated and no united effort has been made to bring about the adoption of a uniform method. A survey of some of the cost methods now in use, and of some of the advantages to be gained by the adoption of a uniform plan of procedure, should readily demonstrate the value of encouraging a movement in this direction.

The average report of road construction costs which is submitted at highway conventions is generally of little value for comparative purposes until the unit costs as given have been translated, as far as this is possible, to agree with the various other units upon which costs of similar projects happen to be based. A report of costs of concrete roads built in the United States in 1914 compiled by the Association of Portland Cement Manufacturers gives separately the total cost, on a square-yard basis, for labor, teaming, mechanical equipment, materials and miscellaneous expenditure. A similar report covering roads built in Wisconsin is made up to give costs per cubic yard of excavation, per cubic yard of concrete for culverts, per square yard of concrete pavement, and per linear foot of bridges constructed. A report submitted recently on the costs of an Illinois highway in Lawrence County gives the following subdivisions on a square-yard basis:

(1) Engineering and general supervision. (2) Superintendence and inspection. (3) Excavation. (4) Loading and unloading material. (5) Hauling stone. (6) Hauling cement. (7) Hauling sand. (8) Hauling incidentals. (9) Hauling and placing shoulders. (10) Shaping and rolling subgrade. (11) Mixing and placing concrete. (12) Covering, seasoning and cleaning concrete. (13) Culverts and bridges. (14) Freight, depreciation or rental equipment. (15) Insurance printing and supplies.

A road cost form as proposed by a committee at the National Conference on Concrete Road Building makes the cubic yard the basis of unit costs for labor, concrete materials, water, plant and forms, reinforcement and joints.

In considering the above methods for dividing the costs of roads as built, it will be readily seen that any attempt to obtain comparative figures for all cases on any one feature of the work would be extremely difficult. To compare, for instance, the cost of mixing and placing concrete per cubic yard would necessitate in three of the above instances additional data regarding depth of concrete and the separation in two instances of that portion of the labor item referring to the mixer operations. The method used in distributing the items of administration, engineering and other overhead expenses is apparently different in each instance noted and would, of course, have to be considered and reconciled in arriving at comparative figures. The above condition which clearly indicates a lack of any real standards on which road construction costs may be based is unquestionably a disadvantage, as it greatly lessens the value to be gained from the publishing of such data as that already noted.

Twofold Advantage of Uniformity

The advantages to be gained from the general use among road builders of a uniform method of road construction accounting will be twofold in operation. First it will provide highway engineers with authentic data of average unit costs for each different feature of highway construction as obtained in best average practice. At the same time the individual road builder who takes advantage of such a method has provided himself with an effective instrument for determining the weak points in his own building operations. Under present conditions the road contractor who may be interested in knowing his costs on the various operations is prevented from realizing the full advantage to be gained from his own figures because of varying standards and the limited data available for comparison.

In advancing a plan for obtaining costs on highway construction and maintenance there are certain features which must be noted as essential in order to arrive at dependable costs.

First in importance is the adoption and use of a satisfactory means of controlling the items of labor and materials as they enter into the construction of the road.

Second in order is the division of the work into such groups as will agree most naturally with the character of operations performed and at the same time readily admit of a classification which will apply to road work in general.

Details of Actual Plan

Finally, it is necessary to provide means for checking the results on the various operations during the progress of the work—in other words, to obtain cost figures on the different portions of the work in time to cut off waste and speed up efforts where necessary on the balance of the work still remaining.

In the following paragraphs the details of a plan now in operation on concrete-road construction are noted to point out how the above-mentioned conditions are provided for in actual practice.

As a means of controlling the labor item the first detail to be considered is the use of the workman's time card. The timekeeper on the job is made responsible for the issuing of one of these cards every payroll period for each man on the payroll. On this card he must record daily the nature of the labor performed and the number of hours in each case, and at the end of the week summarize in the proper space the total hours spent by the man on each class of work. After being approved by the foreman all the cards thus made up are sent into the main office, where the rates are verified, the extensions proved and the amounts due each man entered on the payroll distribution sheet. From this payroll sheet the total labor is distributed to the construction, maintenance and indirect labor items through the construction-cost ledger and maintenance and indirect-expense accounts.

In controlling the stock used in connection with road construction, provision is made for charging each item of material as it is used. All material, which on its receipt is used directly on the road without any attempt at storage, is charged directly from the voucher record through the distribution ledger to the road in question. To take care of materials, supplies and repair parts which are carried in stock, a series of stores accounts are set up. These stores accounts cover separately the different types of materials used in road construction and are made up as follows: tiling, brick, cement, pebbles, sand, limestone, granite, trap rock, tar, gravel, road oil, armor plate, expansion felt, piling, lumber, coal and general stores. As a means of controlling the issuing of stock from these stores a suitable form of stores requisition is used. This requisition is issued in triplicate, one copy being retained by the foreman having authority for its issuance, the second is kept by the storekeeper having charge of the stores, while the third is sent to the main office. This third or office copy is authority for charging the material in question to the proper account through the transfer journal. The operation of such a plan of stores control naturally requires the supervision of this stock by a competent storekeeper with adequate space and suitable conditions for proper storage.

Separation According to Nature of Operations

In considering the division of the work into convenient groups for statistical purposes, the following separation has been made to agree with the variety in the nature of operations performed in the construction of roads:

Hauling—Under this heading are two divisions of Hauling (teams) and Hauling (men). Hauling (teams) will include all labor done by teams in transporting material from stock yard or piles direct to work of construction or to subgrade prepared for such construction. Hauling (men) will cover all work done by men engaged in loading teams at stock piles and in operating and loading and unloading of industrial cars used in material transportation.

Yard Labor—When operations are extensive enough to warrant equipping a special yard with railroad siding for the handling and storing of material in stock piles, yard labor (teams) and yard labor (men) accounts are set up. All work by teams in trucking inside the yard is covered by the first account, while the work of men engaged in unloading material from freight cars and loading teams and industrial cars for transportation to scene of operations is covered by the second.

Subgrade—Tile Drain—Open Ditch—These three accounts cover the work of preparing subgrade with proper drainage facilities, and are each divided between labor by teams and labor by men. The work of grubbing, excavating, filling, rolling and leveling of subgrade, and digging of ditches and laying of tile will be covered by these accounts.

Culverts—This account divided between labor by teams and by men covers all work of digging, construction and preparation of forms, operation of concrete mixer and placing of concrete required in the completion of any culverts found necessary in the construction of the road.

Concrete Mixer—All labor necessary in the operation of the mixer and the actual construction of the road surface is to be included in this account. This will cover transferring materials to mixer, mixer operation, placing concrete, floating, finishing, covering, curing and cleaning.

The indirect items of indirect labor, superintendent and foremen, timekeeper, engineering services and blueprints and drawings are charged direct to the cost of the road through separate accounts which are set up for each.

The administration and general expenses—consisting of engineers' and office salaries and expenses, insurance, automobile expense and items of a similar character—are kept in suitable separate accounts and at the end of the season's operations are spread over all the jobs finished and unfinished on the basis of the productive payrolls disbursed in each case.

Daily Reports Also Used

In reference to that feature of the plan covering a check on the actual construction, a series of daily operating reports is put into use. These reports are made up in a form which will show the number of men engaged on each of the different operations, the amount of cement used, the number of charges and the actual operating time of the mixer, and the total linear feet of road metal completed. In a similar manner figures are given showing time worked and results accomplished on grading, ditching and shoulder work. The data thus furnished daily in these reports are studied and the results of the analysis compared with a reasonable standard such as might be obtained from the results of construction of similar roads. This comparison, which is thus made possible daily, furnishes a valuable index on the effective working of each operating unit involved in the construction of the road.

In reference to the results already accomplished in the construction of such roads, we have just completed a statistical history embracing complete maps, descriptive matter, quantity and kinds of materials used, total

cost of materials, labor, supplies, expenses and overhead charges. This covers unit costs for the same headings per mile, linear foot and cubic yard. A statement is also included showing amounts and dates of money received as state rewards for each road.

As an additional means of providing a measurement of actual construction operations, the plan has been instituted of making up detailed estimates for roads to be constructed. These estimates are made up to include figures showing total amounts of the various materials required, amount of ditching, tile drains and culverts necessary, cubic yards of earth to be handled and mileage and cubic yards of road surface to be constructed. This estimate will include the average number of linear feet to be constructed daily on the basis of the specifications.

As regards the cost of maintenance of the roads already constructed and previously referred to, the following details of method in handling and compiling these accounts should be noted.

The elements of labor and material involved are controlled by means of time cards and requisitions in a similar manner to that already referred to in connection with road construction. The division of the labor and material as distributed over the road metal, shoulders and drainage structure is shown in the following accounts:

(1) Labor on road metal. (2) Material on road metal. (3) Labor on shoulders and drainage structure. (4) Material on shoulders and drainage structure. (5) Extra expenses, intended to cover expenses caused by conditions apart from ordinary road upkeep, such as removing snow and other items of an accidental nature.

Control Over Equipment Necessary

An additional feature to be considered in connection with the above is the proper control of equipment and perishable tools when these items involve any considerable investment and are distributed over considerable area. The means of obtaining this control over equipment is in the use of a suitable plant- or equipment-ledger card. This card is made up to show the descriptive detail of each distinctive piece of equipment with value, rate and amount of depreciation and an identifying series number. As each piece of equipment is sent out for use on a construction job, an entry is made on the reverse side of card showing date, name and location of road and superintendent in charge. On the return of this equipment, or its transference to another job, a proper entry is made giving date and other details of change. The above information is conveyed to the main office, where this record is kept, by means of the standard requisition slip.

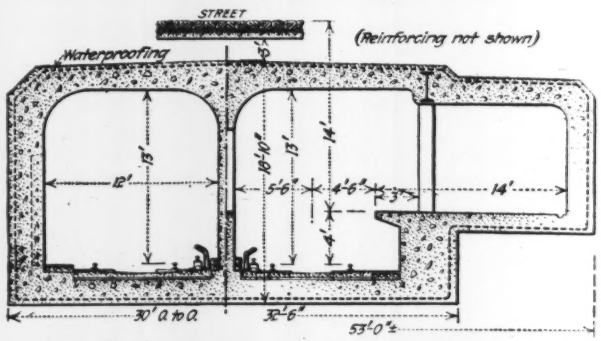
Perishable tools are controlled by the use of a special account for each road superintendent. As these tools are given out by the storekeeper they are requisitioned on the standard requisition form, by which means they are later charged through the transfer journal to the respective superintendents' accounts. In a similar manner proper credit is given for all tools returned so that at the end of the season any balance remaining against the tool account of any superintendent represents the value of such perishable tools as were lost, strayed or stolen.

Reference should be made to the fact that the accounting method as outlined—giving the means of "costing" the various elements of road construction—must have for its basis the principles involved in corporate accounting. This, therefore, involves a complete departure from the methods generally followed in municipal procedure.

Rapid Transit Recommendations for Pittsburgh

Line From South Hills District to East End Should Be Built First—Elevated Railway With Concrete Encasement

DEFINITE proposals for Pittsburgh rapid transit are made in the report of E. K. Morse, transit commissioner of the city. Two lines extending through the business district out to the east end of the city, each about seven miles long, are found to be financially practicable. Either of the two would be able to pay its fixed charges within a few years after starting operation. The one line is largely elevated, the other

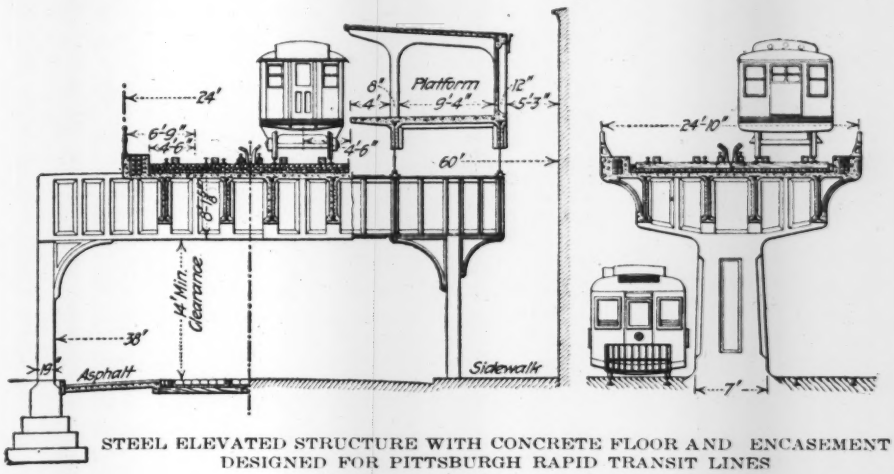


PROPOSED CONCRETE SUBWAY FOR PITTSBURGH

almost wholly subway and tunnel; the former line, being the cheaper, is recommended for first construction.

The reinforced-concrete box type of subway is recommended. An elevated-railway structure has been designed having steel frame, concrete encasement, and ballasted roadbed on concrete slab deck, to reduce noise, drip and maintenance expense.

The preferred line, the South Hills-East End, starts from the south end of the present Mt. Washington tunnel, crossing under the Panhandle tracks and over Carson St., across the Monongahela River by way of a new bridge near Smithfield St., thence through Water and Grant Sts. to Penn Ave., near 12th St., and out along Penn Ave. through East Liberty to Frankstown Ave., terminating at the intersection of Dallas Ave. Practically all this line is elevated, the only subway portion being that along Grant St. The total length is 6.51 mi., excluding the existing tunnel, and the cost is estimated at $7,050,200, or $1,080,000 per mile. This line would have a revenue of about $134,000 per day under present conditions, or about $148,000 when completed (1922). Much of this traffic, however, is taken from existing surface-car lines, and considering the transit system as a whole the net loss



STEEL ELEVATED STRUCTURE WITH CONCRETE FLOOR AND ENCASEMENT DESIGNED FOR PITTSBURGH RAPID TRANSIT LINES

here must be subtracted from the net income of the rapid transit line. Computing on this basis, the first year's net income would be $389,000, representing a deficit of $34,000 below the sum of interest and sinking-fund charges. The deficit would disappear after a year or two through the normal increase of traffic built up by the line.

The second route studied, called the North Side-East End line, North Side (Allegheny), at the corner of North Diamond and West Diamond Sts., across the Allegheny River and through various streets to Forbes St., then along Forbes St., Fifth Ave., private property and Ellsworth Ave. to Frankstown Ave., ending at Dallas Ave., a distance of 6.73 mi., practically all in subway or tunnel. On this account, although the line is only a little longer than the first, it would cost over 50% more ($11,284,100) or about $1,700,000 per mile.

If this line is built in conjunction with or subsequent to the South Hills-East End line, it would not extend out Ellsworth and Frankstown Aves., but would stop near Schenley Park.

If built as an independent route its daily revenue in 1922 would be $130,940, and its annual net income $373,000, yielding a deficit of $304,000 below the interest and sinking-fund charges on the cost.

The subway sections reproduced in the adjoined cut are those designed specifically for the Grant Street portion of the South Hills-East End route. The elevated designs, also worked out for this route, are typical; the single-post elevated is considered to be adaptable only to rather wide streets, such as occur in the East Liberty district.

Concerning the relative value of subway and elevated lines the report states:

"In the past there has been some prejudice against construction of elevated railways in city streets. This prejudice has been based on two objections—unsightly appearance of structure, and noise from operation of cars. By adopting proper designs and methods of construction, both of these objections may be overcome. Encasing the structure in concrete in such a way as to make it architecturally attractive will remove the first objection. By laying the tracks in ballast supported on a reinforced-concrete floor, the noise will be reduced to less than that of a surface car on a paved street. Even such a fine structure as this will cost less than half as much as subway. It is now recognized by transit authorities that few localities have sufficient density of population to support a rapid-transit system built as subway."

After a study of various operating methods, Mr. Morse recommends that all rapid-transit lines be municipally owned, but operated by the same company as that operating the surface-car system. Future extensions of the initial rapid-transit system were projected in such a way as to tap most of the residential centers as far as McKees Rocks and Homestead. Stated in the order in which Mr. Morse recommends their construction, they are:

Extension of the South Hills line from the southerly end of the Mt. Washington tunnel eastward to Knoxville and Mt. Oliver.

Extension of the opposite end of the same route eastward on Frankstown Ave. to Wilkinsburg and southerly to Swissvale.

Further extension of this route to form a complete circuit, from Mt. Oliver through Carrick to Homestead and across the Monongahela River to Swissvale.

Extension of the North Side line westerly to McKees Rocks, crossing the Ohio by way of a county bridge (not yet built).

Branch from South Hills line to Brookline.

Branch from North Side line along East St. and Evergreen Road.

Extension of North Side line from Schenley Park through Squirrel Hill to Edgewood.

The total cost of the extensions and branches would be about $20,000,000, or roughly 50% more than the cost of the two original lines. None of the figures include power stations, cars or yards.

Bulletin Gives Road Construction Data

The "Official Bulletin" for 1917, recently issued by the New York State Commission of Highways, contains a complete list of all county and state roads, so arranged that the full details and costs of construction may easily be learned by any one who will take the trouble to note the number of the highway, which is given on the signs at the beginning and end of each route. The various state and county highways are arranged in numerical order in a table. By means of a well-conceived system of abbreviations and key numbers, and by occasional reference to the explanatory notes, the following data may be obtained: Length in miles; width of pavement and roadway; character and thickness of materials entering into the original construction; number of square yards; cost of construction; percentage completed; type and date of resurfacing, and the county in which the route is located.

Electric Operation Permits Economical Gravel Plant Layout

One Man Handles Excavation by Dragline Cableway—Gravity Used to Advantage in Screening Plant

By E. Earl Glass
Monrovia, Calif.

ELECTRIC operation and automatic control simplify the labor problem at a gravel plant recently completed in southern California. The entire plant, including the excavating cableway, is equipped with electric motor drive. One man controls every digging operation, even including the shift of the free end of the 1200-ft. cableway by a motor located on the far side of the river. Full advantage is taken of gravity in the layout of the screening plant, for after the initial lift on the inclined railway from crusher to screens there is only a single 20-ft. elevator required to complete screening operation.

The San Gabriel River, near Los Angeles, on which this new crusher plant of the Southern California Rock and Gravel Co. is located, is a torrential stream, and though it is dry at this point the greater part of the year, it has carried down débris with the spring floods until it has built up a great delta of granite cobbles, gravel and sand extending far into the valley from the mouth of this mountainous canyon. These materials are excellent for building, concrete and road work and there is a good market for the gravel and broken stone. Most of the local crusher output goes into the construction of roads.

The plant is on the west bank of the river, two miles below the mouth of the canyon and between two bridges. A 4 cu.yd. dragline bucket is operated from a high-line of two 2-in. cables 1200 ft. long, pivoted over sheaves on top of the crusher tower, to swing the length of the opposite bank between the two bridges. This gives a sector of about 600 ft. arc and 1200 ft. radius as the first pit area. As the gravel extends to a great depth, it is expected that this area will maintain the plant, with the annual renewal by the spring floods washing the pit full of stone from up stream. As the heavy floods last only a week or two, the water will hardly interfere with operation of the plant.

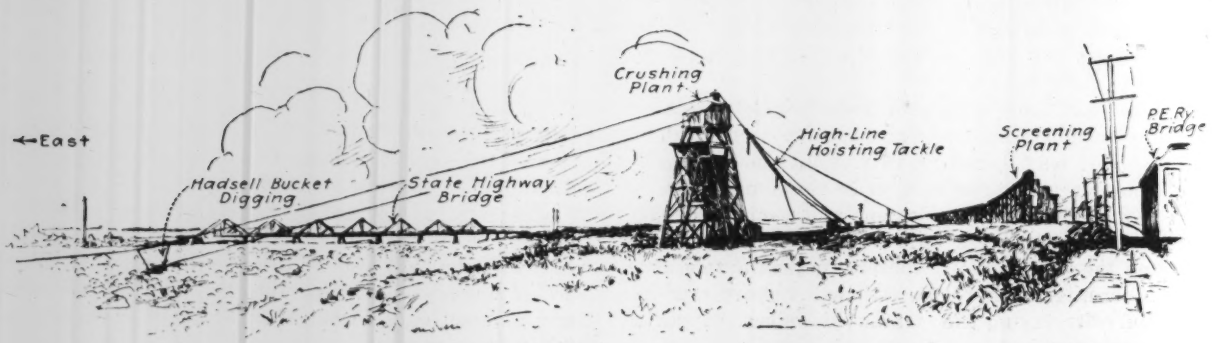
If this area should not prove sufficient, the east end of the cable may be swung south and west to excavate the full radius south of the screening plant.

The hoist room is 25 ft. square with a reinforced concrete floor slab on a bridge turntable. By an eccentric pull with a hoist cable, the entire building is swung to maintain a position normal to the main cables. In this room is a 300-hp. motor-driven hoisting drum with pneumatically-operated clutch and brakes, and on this is the 1¼-in. drag-line cable. Beside it is a 100-hp. motor and winding drum for elevating the high line cables by the tackle west of the tower. These motors are operated through automatic switchboards by controllers on the operator's deck above them. There is also a controller for the motor housed across the river for swinging the free end of the high line up or down stream. This gives a one-man control for all the excavating operations.

The bucket dumps upon a grizzly of railroad rails into a 1000-ton ore bin with a bottom discharge closed by balanced knee frames. This chute has a grating of 2-in. bars spaced 9 in. apart, the oversize going into a No. 12 Gates gyratory crusher and the undersize going with the crushed stone to a concrete slab on the ground. This is the roof of a concrete tunnel which is the loading room for the cars at the foot of the inclined tramway. The car loading gate is air-controlled.

The large crusher is operated by a 175-hp. motor housed beside it. On the same level of this tower is the compressor room with a 75-hp. motor driving a compound 10 x 12-in. compressor. A 75-hp. motor-driven hoist at the head of the screening plant tower lifts the two 5-yd. dump cars on the inclined trestle to the hopper of a 5-in. and 2-in. concentric revolving screen. The oversize from the screen drops to a No. 5 Gates gyratory crusher driven by a 40-hp. motor; the 5-in. to 2-in. material passing into a 48-in. disk crusher, the two screenings being chuted to the discharge of this disk crusher. A 75-hp. motor drives the disk crusher and revolving screen. The gyratory crushers have been fitted with ½-in. pipe to the gear and pinion from an elevated barrel of lubricating oil. The drip is caught and used again. This gives a simple sight feed system which dispenses with the daily lubricating with grease and is much more effective. The opposed pulleys of the disk crushers are driven by back gearing from the countershaft, which is an improvement on the twisted belts commonly used.

On the deck below this crushing floor are two shaking screens, one wet and one dry. The stone from the No. 5 gyratory crusher drops to the dry screen, which is made up of four screens 3 ft. wide by 20 ft. long with



GRAVEL PLANT IS LOCATED SO THAT PIT WILL BE REFILLED WITH MATERIAL YEARLY BY FLOODS

3-in., 1½-in. and ¾-in. perforated sheets over a 4-mesh wire screen. The wet screen is similar to this but the sizes are 2-in., 1-in. and ½-in. perforated sheets and 8-mesh wire screens. A 3-in. pipe branches to two 2-in. parallel pipes 17-ft. long over the washing screen. Each of these pipes has two rows of ½-in. holes drilled 6-in. apart on the under side.

The sized stone drops through chutes to the proper bin and the oversize from the screens can be lifted by an elevator to a 36-in. disk crusher, from which it returns to the dry screen. Both this crusher and the elevator are driven by a 50-hp. motor. It may be noted that this 20-ft. lift is the only elevator on the job. The fines from the wet screen fall in a settling tank with a sloping bottom, up which they are carried and drained by a screw conveyor and are dropped into their bin. A 30-hp. motor drives the two screen sets and the screw conveyor.

The 2000-ton track bins have 12 compartments over two tracks and the ground north of the plant is to be used for storage, the chutes discharging over the track bins to a pile beside the plant and a 40-ft. electric crane swinging the stone to stock piles. The yards are well supplied with track for switching and car storage and the plant is on both the Southern Pacific and Pacific Electric railroads.

A 16-in. cased well was drilled, getting water at a depth of 125 ft. It is fitted with an 8-in. pump and 25-hp. motor, lifting to a 25,000-gal. concrete reservoir. A 25-hp. motor direct connected to a 6-in. centrifugal pump boosts 675 gal. per min. (rated capacity) to a 2000-gal. tank above the washing screen.

The towers are each 125 ft. high and are 1200 ft. apart, making the plant half a mile long over all. This was partly to remove the screening plant from the low river bank, and where there was possibility of washout, and to obtain a generous switching yard.

The builders rate the capacity of the plant at 2000 tons per 10-hour day. As part of the equipment was transferred from a former property of the same company at Acton, Calif., no definite cost can be given; but the complete plant represents an investment of about $500,000.

H. G. Feraud is president of the Southern California Rock and Gravel Co., and the Fulton Engine Works of Los Angeles built the plant described.

Organization of Government Railroad Administration

Committee of National Chamber of Commerce Shows by Chart the Branches of Regional, Central and Advisory Sections, and Explains Their Functions

A COMPREHENSIVE organization chart of the Government railroad administration has been prepared by the railroad committee of the Chamber of Commerce of the United States, in connection with the committee report at the convention of the Chamber of Commerce in Chicago this week. The report is mainly an explanation of the chart, and the following, together with the chart itself, is taken from the report:

In a proclamation issued Dec. 26, 1917, the President "took possession and assumed control of each and every system of transportation and the appurtenances thereof located wholly or in part within the boundaries of the continental United States and consisting of railroad, and owned or controlled systems of coastwise and inland transportation, engaged in general transportation, whether operated by steam or by electric power, including also terminal companies and terminal associations, sleeping and parlor cars, private cars and private lines, elevators, warehouses, telegraph and telephone lines and all other equipment and appurtenances commonly used upon or operated as a part of such rail or combined rail and water systems of transportation—to the end that such systems of transportation be utilized for the transfer and transportation of troops, war material and equipment to the exclusion, so far as may be necessary, of all other traffic thereon; and that so far as such exclusive use be not necessary or desirable such systems of transportation be operated and utilized in the performance of such other services as the national interest may require and of the usual and ordinary business and duties of common carriers."

At the same time the President directed "that the possession, control, operation and utilization of such transportation systems shall be exercised by and through W. G. McAdoo, who was appointed and designated Director General of Railroads.

The immediate staff of the Director General includes an assistant who resigned as chairman of the board of one of our greatest railroad systems to accept this position; a general counsel assisted by an able legal staff, a regional administration including three regional directors in charge of the Eastern, the Southern and the Western Districts; a Central administration including six administrative divisions; and a number of advisory committees composed of men selected because of their special fitness for the tasks entrusted to them.

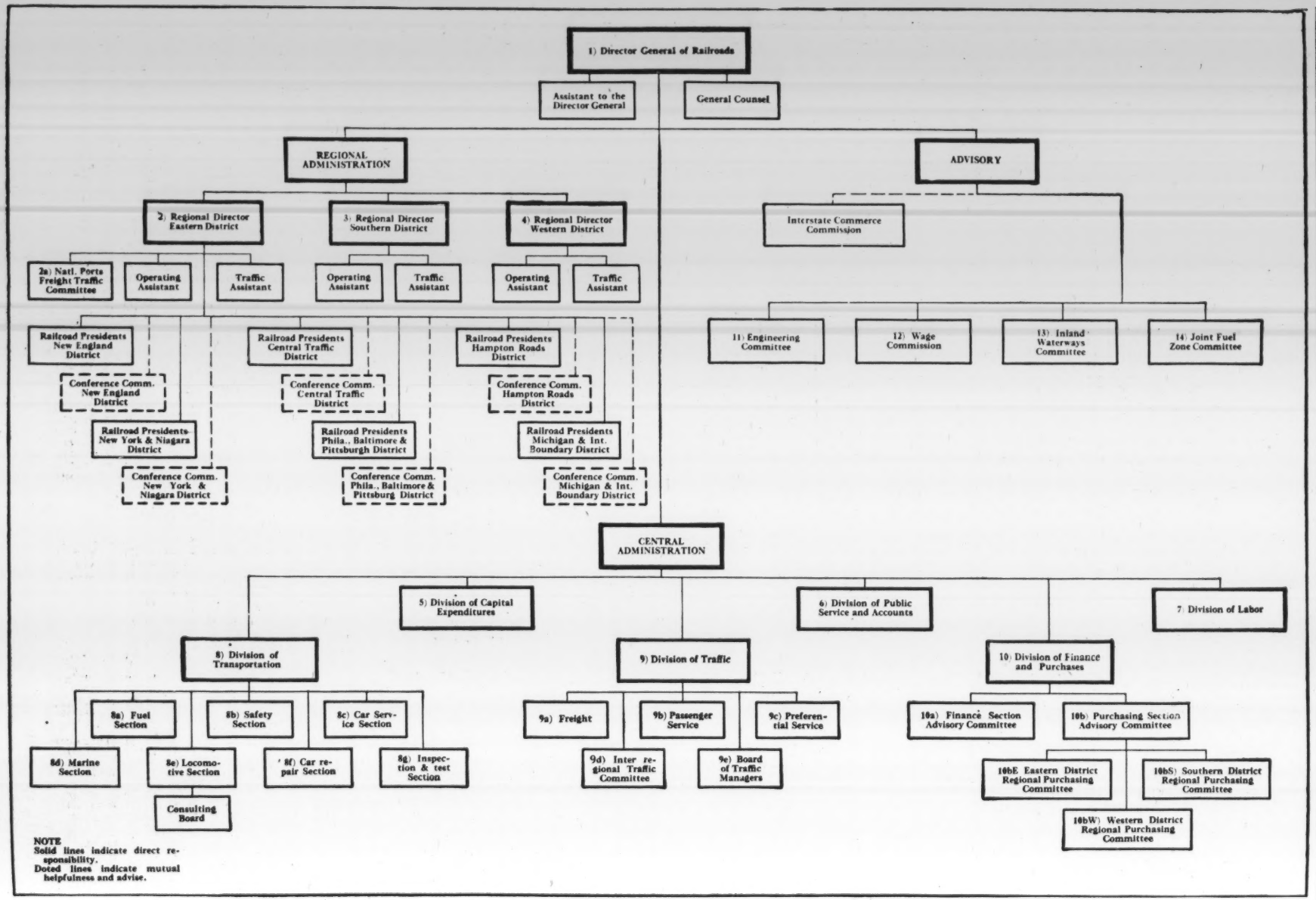
The interstate Commerce Commission retains its powers under the Act to Regulate Commerce, subject to such modifications as are obviously necessary in time of war; and under the recently enacted railroad bill acts as the adviser of the Director General in all matters that come within its province.

Regional Administration

For purposes of operation the railroads of the United States classified as Eastern railroads, Southern railroads and Western railroads, defined as follows:

Eastern Railroads—The railroads in that portion of the United States north of the Ohio and Potomac Rivers and east of Lake Michigan and the Indiana-Illinois State line; also those railroads in Illinois extending into that state from points east of the Indiana-Illinois State line; also the Chesapeake & Ohio, the Norfolk & Western and the Virginian railways.

Southern Railroads—All railroads in that portion of the United States south of the Ohio and Potomac Rivers


1) Director General of Railroads
Assistant to the Director General
General Counsel
REGIONAL ADMINISTRATION
ADVISORY
2) Regional Director Eastern District
3) Regional Director Southern District
4) Regional Director Western District
Interstate Commerce Commission
2a) Natl. Ports Freight Traffic Committee
Operating Assistant
Traffic Assistant
Operating Assistant
Traffic Assistant
Operating Assistant
Traffic Assistant
11) Engineering Committee
12) Wage Commission
13) Inland Waterways Committee
14) Joint Fuel Zone Committee
Railroad Presidents New England District
Conference Comm. New England District
Railroad Presidents New York & Niagara District
Conference Comm. New York & Niagara District
Railroad Presidents Central Traffic District
Conference Comm. Central Traffic District
Railroad Presidents Phila., Baltimore & Pittsburgh District
Conference Comm. Phila., Baltimore & Pittsburg District
Railroad Presidents Hampton Roads District
Conference Comm. Hampton Roads District
Railroad Presidents Michigan & Int. Boundary District
Conference Comm. Michigan & Int. Boundary District
CENTRAL ADMINISTRATION
5) Division of Capital Expenditures
6) Division of Public Service and Accounts
7) Division of Labor
8) Division of Transportation
9) Division of Traffic
10) Division of Finance and Purchases
8a) Fuel Section
8b) Safety Section
8c) Car Service Section
8d) Marine Section
8e) Locomotive Section
8f) Car repair Section
8g) Inspection & test Section
Consulting Board
9a) Freight
9b) Passenger Service
9c) Preferential Service
9d) Inter regional Traffic Committee
9e) Board of Traffic Managers
10a) Finance Section Advisory Committee
10b) Purchasing Section Advisory Committee
10bE Eastern District Regional Purchasing Committee
10bS) Southern District Regional Purchasing Committee
10bW) Western District Regional Purchasing Committee
NOTE
Solid lines indicate direct responsibility.
Doted lines indicate mutual helpfulness and advise.

ORGANIZATION OF GOVERNMENT'S RAILROAD ADMINISTRATION AS CHARTED BY RAILROAD COMMITTEE OF NATIONAL CHAMBER OF COMMERCE

1) DIRECTOR GENERAL OF RAILROADS

William G. McAdoo, Director General
Oscar A. Price, Private Secretary

Walker D. Hines, Assistant to the Director General
H. A. Taylor, Assistant

John Barton Payne, General Counsel
Nathan Matthews, Assistant
William Ellis, Assistant

INTERSTATE COMMERCE COMMISSION

Winthrop M. Daniels, Chairma
Henry C. Hall

Edgar E. Clark
James S. Harlan
Charles C. McChord
Balthasar H. Meyer
Clyde B. Aitchison
Robert W. Woolley
George W. Anderson
George B. McGinty, Secretary

REGIONAL ADMINISTRATION

2) Eastern District
New York City

Alfred H. Smith, Regional Director
H. A. Stone, Assistant
G. F. Randolph, Traffic Assistant
H. W. Burnham, Secretary

2a) National Ports
Freight Traffic Committee
New York City

George D. Ogden, Chairman
Francis La Bau
Richard Van Ummerson
Robert L. Russell
Archibald Fries
Joseph R. Ruffin
Elmore D. Hotchkiss

RAILROAD PRESIDENTS

The President of each railroad in Eastern territory in charge of his own road

CONFERENCE COMMITTEES

Conference Committee of Presidents in each district acting as clearing house of mutual assistance and information

New England District Committee
Boston Sub-Committee
New York and Niagara Frontier
District Committee
New York Sub-Committee
Buffalo Sub-Committee

Central Traffic District Committee
Cleveland Sub-Committee
Columbus Sub-Committee
Cincinnati Sub-Committee
Indianapolis Sub-Committee
Chicago Sub-Committee
St. Louis Sub-Committee

Philadelphia, Baltimore and
Pittsburgh District Committee
Philadelphia Sub-Committee
Baltimore Sub-Committee
Pittsburgh Sub-Committee

Hampton Roads District Committee
Norfolk Sub-Committee

Michigan and International Boundary District Committee
Detroit Sub-Committee

3) Southern District
Office, Atlanta

C. H. Markham, Regional Director
L. W. Baldwin, Operating Assistant
Charles R. Capps, Traffic Assistant

3a) Southern Ports Freight
Traffic Committee

C. T. Airey, Chairman

RAILROAD PRESIDENTS

The President of each railroad in Southern territory in charge of his own road

CONFERENCE COMMITTEES

Conference Committee of Presidents acting as clearing house of mutual assistance and information

4) Western District
Office, Chicago

R. H. Aishton, Regional Director
M. J. Gormley, Operating Assistant
J. G. Woodworth, Traffic Assistant

RAILROAD PRESIDENTS

The President of each railroad in Western territory in charge of his own road

CONFERENCE COMMITTEES

Conference Committee of Presidents acting as clearing house of mutual assistance and information

CENTRAL ADMINISTRATION

5) Division of Capital Expenditures

Robert S. Lovett, Director
F. B. Adams, Engineering Assistant
F. W. Sercombe, Accounting Assistant
C. T. Bower, Secretary and Assistant

6) Division of Public Service
and Accounts

Charles A. Prouty, Director
Luther M. Walter, Assistant

7) Division of Labor

W. S. Carter, Director
J. A. Franklin, Assistant

8) Division of Transportation

Carl R. Gray, Director
W. C. Tyler, Assistant Director
H. T. Bentley, Assistant in Charge of Mechanical Matters

8a) Fuel Section

H. A. Cochran, Manager

8b) Safety Section

Hiram W. Belknap, Manager

8c) Car Service Section

W. C. Kendall, Manager
W. L. Barnes
E. H. DeGroot
A. G. Gutheim
C. B. Phelps
G. F. Richardson
J. A. Sommerville } Assistant Managers

8d) Marine Section

W. H. Pleasants, Manager
B. J. Henry, Assistant

8e) Locomotive Section

Frank McManamy, Manager

8g) Inspection and Test Section

C. B. Young, Director

CONSULTING BOARD

H. T. Bentley
C. E. Chambers
C. E. Fuller
J. Hainan
D. R. MacBain
John Purcell

8f) Car Repair Section

J. J. Tatum

9) Division of Traffic

Edward Chambers, Director
C. B. Buxton, Personal Assistant
R. C. Wright, Assistant Director
(9a Freight Matters)
Gerritt Fort, Assistant Director
(9b Passenger Matters)
G. A. Kirtley, Assistant in charge of
(9c Preferential Service)

9d) Inter Regional
Traffic Committee

B. L. Winchell, Chairman
G. F. Randolph
T. C. Powell

9e) Board of Traffic Managers
representing the Director
General in their Departments

D. L. Gray, Shipping Board
H. M. Adams, War Department
H. P. Anewalt, Navy Department
J. A. Middleton, Fuel and Oil Administrations
Conrad W. Spens, Food Administration
F. M. Whittaker, Appointed by the Railroad Administration to cooperate with the Fuel Administration

10) Division of Finance and Purchases

John Skelton Williams, Director

10a) Finance Section

Advisory Committee

Franklin Q. Brown
Festus J. Wade
Frederick W. Scott

10b) Purchasing Section

Central Advisory Committee

Henry B. Spencer
Samuel Porcher
George G. Yoemans

Regional Purchasing Committee
10bE) Eastern District

E. H. Bankhard
S. B. Wight
E. T. Burnett

10bS) Southern District

F. H. Fechtig
Albert C. Mann
H. T. Shanks

10bW) Western District

Charles A. How
L. S. Carroll
F. A. Bushnell

ADVISORY

11) ENGINEERING COMMITTEE
New York City

Francis B. Stuart, Chairman
A. T. Harden
A. C. Shand
H. A. Lane

12) WAGE COMMISSION

Franklin K. Lane, Chairman
Charles C. McChord
J. Harry Covington
William R. Willcox
W. A. Ryan, Secretary
F. W. Lehman, Counsel
Charles P. Neill
A. O. Wharton, Board of Statistics
Fred A. Burgess

13) INLAND AND COASTWISE
WATERWAYS COMMITTEE

Maj. Gen. William Black, U. S. A., Chn.
G. A. Tomlinson
Walter S. Dickey
Calvin Tompkins
M. J. Sanders
Col. Charles Kellar, U. S. A., Secretary

14) JOINT FUEL ZONE COMMITTEE

Howard Elliott
A. G. Gutheim

Samuel A. Taylor
C. E. Lisscher
G. N. Snider } Fuel Administration

PERSONNEL OF GOVERNMENT'S RAILROAD ADMINISTRATION, SHOWN BY THE ORGANIZATION CHART ON THE PRECEDING PAGE

and east of the Mississippi River, except the Chesapeake & Ohio, Norfolk & Western and the Virginian railways; and also those railroads in Illinois and Indiana extending into those states from points south of the Ohio River.

Western Railroads—All railroads not included in the above definitions and, broadly speaking, all railroads in the territory west of Lake Michigan and of the Indiana-Illinois state line to the Ohio River and west of the Mississippi River from the Ohio River to the Gulf of Mexico, except those railroads in Illinois included in Eastern territory, and those railroads in Illinois and Indiana included in Southern territory, as above stated.

A regional director is appointed for each of the three districts and orders issued by him are issued by the authority of the Director General. Each regional director has appointed an operating assistant and a traffic assistant. In the Eastern district there is also a National ports freight traffic committee which reports to the regional director; and in the Southern district a Southern ports freight traffic committee which reports to the regional director.

In each district the president of each railroad is in charge of his own road and reports to the regional director; and the director keeps in constant touch with a conference committee of presidents in his district which acts as a clearing house of mutual assistance and information.

Central Administration

The Central administration with officer in Washington includes six important divisions, each in charge of a director.

The director of the Division of Capital Expenditures receives and passes upon the reports made by the railroads as to their budgets of necessary expenditures for improvements; and in general has supervision over capital expenditures.

The director of the Division of Public Service and Accounts has charge of questions raised by any portion of the public as to the adequacy of the service rendered shippers and consignees. He supervises the inventories of the railroad properties of which the Government has possession and control, together with receipts and expenditures in connection with their operation. He therefore represents the interests of the farmers, manufacturers, producers and consumers generally.

The director of the Division of Labor deals with railroad labor problems—not only the problems of wages and conditions, but also the problem of aiding the railroads in obtaining sufficient labor and of bringing about a better understanding between officers and employees.

The director of the Division of Transportation has general supervision of all matters affecting railroad operation. This division includes seven sections as follows:

Fuel Section—The manager of the Fuel Section deals with problems involved in securing fuel for all the railroads of the country.

Safety Section—The manager of the Safety Section has direct supervision over the safety work on all roads, utilizing such safety organizations as are already available and suggesting such others as are desirable, in addition to his present duties for the Interstate Commerce Commission as chief of the Bureau of Safety.

Car Service Section—The manager of the Car Service Section (which replaces the Commission on Car Service of the American Railway Association) is in charge of all matters relating to car service, including (a) the relocation of freight cars; (b) provision through the regional director on application of proper governmental authorities for preference in car supply and movement where more than ten cars are involved; and (c) the recommendation of embargo policies and exemptions as the needs of the Government, seasonable requirements or other circumstances may demand.

Marine Section—The manager of the Marine Section supervises the operation of the shipping that is under the control of the Director General; and also gives special attention to coördinating the relation between all other shipping (including that on the Great Lakes) and the railroads.

Locomotive Section—The manager of the Locomotive Section supervises the condition of and repairs to locomotives at all railways shops and round houses and at outside shops, in addition to his present duties as chief inspector of locomotives for the Interstate Commerce Commission. The consulting board of the Locomotive Section considers matters relative to the maintenance of locomotives, the distribution of locomotives to various shops for repairs, shop production and practices and other activities of a similar character.

Car Repair Section—The manager of the Car Repair Section supervises the condition of and repairs to freight and passenger cars in all existing railway shops and at outside shops.

Inspection and Test Section—The manager of the Inspection and Test Section has charge of the test and inspection of materials and work in connection with the construction of standard locomotives and cars.

The director of the Division of Traffic deals with matters involving traffic relations between carriers and relations between carriers and their patrons including the classification of traffic, the determination of charges and the settlement of claims made by passengers and shippers. His staff includes an assistant director for freight matters, an assistant director for passenger matters, and an assistant for preferential service.

The Inter-Regional Traffic Committee is making a study of the larger traffic movements with a view to seeing what steps can be taken advantageously in order to shift traffic from the more seriously congested gateways to the less congested gateways and from the more congested ports to the less congested ports, as well as the more advantageous distribution of such traffic. The committee deals principally with the questions affecting movements of traffic between the three regions and its work will not interfere with similar studies which are being conducted under each of the three regional directors with reference to matters within their respective jurisdictions.

The Board of Traffic Managers representing the Director General in their departments includes the traffic executive of the Shipping Board, the traffic executive of the War Department, the traffic executive of the Navy Department, the traffic executive of the fuel and oil ad-

ministrations, the manager of the traffic department of the food administration and a representative appointed by the railroad administration to coöperate with the fuel administration, which also has a representative on the board.

The director of the Division of Finance and Purchases is responsible for (a) the coördination and supervision of railroad purchases of materials and supplies; and (b) the development of plans for meeting the financial requirements of the railroads whether their needs relate to the taking up and renewal of maturing obligations and the issuance of new securities, or to financial provision for betterments and additions.

Finance Section—The director is assisted in the financial work of the division by an advisory committee of three men experienced in finance, selected one from the North, one from the West and one from the South.

Purchasing Section—He is assisted in the matter of purchases for the railroads by a central advisory committee composed of three men drawn from the purchasing departments of leading railroad systems; and by three regional purchasing committees with headquarters at New York, Chicago and Atlanta in close touch with the three regional directors. The regional committees are instructed (a) to consider as soon as possible the opportunities for standardizing and consolidating purchases of every kind that may admit of such treatment; and (b) to submit to one another and to Washington as information and for criticism full statistics as to cost prices of materials used in railroad operation so that these prices can be carefully compared and checked.

Advisory

The Engineering Committee is making a special study of the plans for the additions and betterments (including equipment) and road extensions that were recommended by railroads in the Eastern District in reply to the questionnaire sent to the railroads by he Director General Feb. 2, and will submit a report on additional facilities needed in that district.

The Wage Commission is charged with responsibility for making a general investigation of the compensation of persons in railroad service, the relation of railroad wages to wages in other industries, the conditions respecting wages in other parts of the country, the special emergency respecting wages which exists at this time owing to war conditions and the high cost of living as well as the relation between different classes of railroad labor.

The Inland and Coastwise Waterways Committee is instructed to make a prompt investigation and to report as soon as possible a definite plan describing the extent to which and the manner in which additional use may be made of internal waterways for the economical and expeditious movement of the traffic of the country so as to relieve or supplement the railways under existing war conditions. While the entire waterway and transportation situation is to be scrutinized, only those waterways that will effectively afford national relief will be included in the plans presented.

The Joint Fuel Zone Committee has prepared a report consumer. Under the zone system coal will be distribtion of bituminous coal during the coal year beginning Apr. 1, 1918. Heretofore coal has been distributed practically without regard to the distance between mine and consumer. Under the zone system coal will be distributed to consuming territory under restrictions that will avoid as far as possible waste of transportation facilities but will nevertheless be consistent with the maintenance of the greatest possible production and a proper coal supply to all coal dealers. Every effort has been made, however, to preserve long established trade relations.

War Prices on Pending Contracts

Contractors Need National Organization to Present Case—Modifications Favored by Decisions

By William B. King
Of the Bar of the Court of Claims, Washington, D .C.

MUCH has been said in the newspapers about the heavy profits of contractors with the United States under the "cost plus" plan in erecting buildings for the Army, Navy and Shipping Board. Little has been heard of the great hardships of other contractors who had made contracts with the Government for engineering and construction work before the war at prices then suitable, but whose costs have gone far beyond their expectations and have greatly exceeded their contract prices. Many contractors who have been doing river and harbor work under contracts containing fixed unit prices have found themselves heavy losers. This is also true of contractors for erecting public buildings under the Treasury Department.

Contractors who have visited Washington to try to get relief have generally been met by the rigid statement that their contracts were in force and bound them to do the work for a fixed sum and that no relief could be extended to them. A more appreciative spirit seems likely to be shown by the State of New York, as a result of the annual report of the State Engineer and Surveyor, and the consequent legislation enabling a readjustment of public contracts now being considered.

Can Government Give Relief?

Is it possible for the United States authorities to take action to relieve contractors of the enormous and unexpected burden which, without their fault, they are carrying? An interesting opinion by former Attorney General Wickersham would indicate that this is possible. In the case before him a contractor had agreed to furnish cotton gloves to the War Department, to be made abroad. Shortly thereafter the duty on cotton gloves was increased 120%, resulting in a heavy loss to him. It had previously been held by the officers of the Treasury Department that the contract could not be annulled or modified except where it was to the pecuniary interest of the United States so to do. The Attorney General said that this was wrong and that it was within the power of the head of a Government department to act toward a contractor with the same regard to fairness and justice as a private individual might under like circumstances. He quoted a distinguished predecessor in saying that "there is nothing in the nature of our institutions which requires officers of the Government to perpetrate an act of injustice in the name of the United States." The enforcement of the contract in the case before him, he said, would be contrary to the prin-

ciples underlying our republican form of government and would expose the Government to merited reproach. He quoted an opinion of the Supreme Court of the United States which decided that a debt may be due from the United States not alone on principles of law but on the general principles of right and justice, "based upon considerations of a moral or merely honorary nature such as are binding upon the conscience or honor of the individual."

The Government itself, in making demands upon the labor supply of the country for pressing war needs, has necessarily increased the price of labor, in many localities doubling it. The needs of the Government have not only caused a great rise in the price of materials but have made many materials almost unobtainable by contractors engaged in war work. Costly delays have necessarily occurred. These conditions have arisen through a cause over which the contractors had no control and under circumstances which could not have been expected by them. Even as late as the November election of 1916 a majority of the people of this country believed that war could be avoided.

Contractors Need National Organization

What plan ought the contractors to adopt in order to obtain relief? They should immediately follow the advice given by the director of the Council of National Defense to the trades of the country affected by the war, to create a national organization and empower a committee to represent them at Washington. This committee should be supported at the expense of the contractors jointly and be assisted by every possible agency for doing effective work. An appeal should be made to all the officers of the Government who are directly concerned with such contracts, including the heads of departments, with the primary view of securing relief through the action of the departments themselves in accordance with the opinion of the Attorney General as quoted. Contracts should be modified so as to provide lump sum or unit prices based upon war conditions, or the contracts should be changed from fixed prices to cost plus. Where that is impracticable, contracts should be abrogated upon terms which would protect the contractor from loss, even if it deprived him of profit.

It is impossible to expect that action of this sort can be obtained by every contractor coming to Washington individually, hurriedly presenting his case to the officer who may be available on the day of his arrival and leaving the matter until brought up by another chance visitor. The amount involved to the various contractors is enormous and vigorous effort is certainly worth while, even if it should involve some outlay upon a chance of success. It has already been left too long.

If the heads of the executive departments are not willing to give relief, then it is highly probable that they would make a favorable recommendation to Congress for a provision for relief in all these cases.

Any committee appointed by the contractors should see that one of their number remains in Washington to follow up all the aspects of this contention until final success or until it is clearly ascertained that nothing can be done.

Is it possible that the courts will give any relief, if a proper case is brought before them? The general rule laid down in the courts is that only actual physical impossibility excuses a party in law from the performance of a contract once undertaken. No matter how great the extent of financial loss, the party is to be held to his contract, though it may force him into the bankruptcy court. Yet there has been some relief from the strictness of this harsh rule by the courts holding in some instances that a contract may be void because conditions have arisen which could not have been in the contemplation of either party when the contract was made. The U. S. Supreme Court said in one case:

"But where the event is of such a character that it cannot be reasonably supposed to have been in the contemplation of the contracting parties when the contract was made, they will not be held bound by general words, which, though large enough to include, were not used with reference to the possibility of the particular contingency which afterward happens."

A case in line with this principle was decided by the Supreme Court of the United States since the beginning of the European war. The German steamship "Kronprinzessin Cecilie" started from New York for Germany on July 28, 1914, and turned back when about half way over, fearing a declaration of war and possible capture. She had a large amount of gold on board destined for England. The owners of the gold libelled the vessel for breach of contract in turning back and asked damages for its failure to transport the gold to its destination. The Supreme Court declared that it could not find in the terms of the contract any words which expressly permitted the vessel to turn back or relieved it from liability for not delivering the gold, but said:

"Business contracts must be construed with business sense as they naturally would be understood by intelligent men of affairs."

It was held that, even though the vessel might have delivered the gold before the outbreak of war, the master acted as a prudent man having due regard to the interests of all concerned. It was said that he was "not to be put in the wrong by nice calculations that if all went well he might have delivered the gold and escaped capture by the margin of a few hours." This is the recognition of a principle which might very well be set up in the cases of these Government contractors, that they undertook their contracts upon the basis of ordinary existing conditions and could not have contemplated so overwhelming a change in conditions as was caused by the war. It cannot be said that an attempt to gain redress by action in court could be expected with any degree of confidence to result in success, but it can be said that the matter is arguable and that the amount involved, if all contractors were united in a test case, is great enough to make the burden upon each contractor small in proportion to his interest. At any rate, contractors may very properly protect themselves by written protests.

It seems strange that Government contractors for engineering work have not united in an association to guard their common interests and to secure better conditions. The forces separating them have always seemed stronger than those uniting them. This is one of many instances where such an organization might be of great use to them.

LETTERS TO THE EDITOR

Comment on Matters of Interest to Engineers and Contractors Will Be Welcome

Kutter's *n*, Draftsmen and Folding Beds

Sir—Oppressed this gray morning with the manifold sorrows of life, I mingled my drink (breakfast coffee) with tears and on reaching the office took up one of your recent issues, hoping only for solace. On reaching the notice of another table for solving Kutter's never-to-be-sufficiently-anathematized formula, my cup of bitterness overflowed. *Et hinc illae lacrimae.*

An eminent jurist has proposed as a principle of penal law that "the punishment fit the crime." Were this adopted in our country, do you think it would be enough to compel all authors of new tables or curves illustrating the complexities of that grave of the progress of the noble science of hydraulics to compute from the beginning a seven-place log table? Would not this awful fate prove a most humane warning to those enthusiasts who publish curves for designing structural columns, flange angles of plate girders, reinforced concrete, etc.? Does anybody ever clip them from the pages of technical journals and really use them? And, by the way, is there any need (except vanity) for the constant stream of elementary text-books on statics, hydraulics, surveying?

And, sir, why do you publish so many articles bewailing the public's lack of financial appreciation of engineers' work? For example, is it credible that large corporations employing lawyers, physicians and many other classes of business men should actually discriminate against their engineers? We get just about what we deserve, and while I wish it were more, I fear we don't get it because we aren't worth more to the world under its present social organization. Many business men enjoy very large incomes which the philosopher may believe they do not earn but which they certainly are worth in the prevailing scheme of capitalistic control of industry. Were society reorganized on another basis we might be worth more and they less, but even this is a debatable point.

I have always believed that structural draftsmen are underpaid for the responsibility that rests upon them, but that belief has been shaken somewhat by the testimonials which the correspondence schools are fond of printing—"I was formerly a machinist, but thanks to your course in drafting I am now draftsman for the ——— company and draw better pay for shorter hours and easier work." Nobody takes up drafting without knowing exactly the remuneration he may expect, but nevertheless there are always plenty of men whom it attracts.

Some of your correspondents are quite worked up because good construction foremen command larger wages than recent technical graduates. I fail to see why a man whose character enables him to manage other men and who has acquired a mastery of some of the exacting requirements of modern construction work may not be more useful to society than a young man, with a year's experience as instrumentman or inspector, who was fortunate enough to have been given a college education. Do chemists, bacteriologists, investigators in pure science, clergymen—all of whom are college men—grow wealthy on their salaries?

Surely no one will claim that it requires any special degree of intelligence to graduate from the average technical school. It seems to me the professors would somehow have failed in their work if almost any graduate of a good high school who had a liking for engineering, should not take his degree, provided, of course, that he applied himself seriously.

It is said that in many cases a college education educates all the common sense out of a man. I am a college graduate—and an "honor" one at that—and I can ratify that statement. Not long ago we bought a folding bed, of a type used in South America. It took the man who brought it and me a half hour to get it through a narrow crooked passage and set it up in a very small room, in plan a trapezium. Yesterday morning while I was away my wife and her maid took it down, moved it to another room and set it up again in about five minutes. Engineers are not in high standing at our house.

CYRUS TOWNSEND BRADY, JR.,
Buenos Aires. United States Steel Products Co.

How Pittsburgh's New Building Code Is Being Made

Sir—In connection with your news item of Feb. 28, 1918 (p. 434) about the Pittsburgh Building Code Committee, it is believed that the engineering and contracting profession would be interested in the method of organization and plan under which this committee is working.

The committee is made up of representatives appointed by various public organizations. The members of the organizations are directly interested in the results, and their business interests are more or less affected thereby.

Realizing so large a body is unwieldy and works slowly, sub-committees were appointed having charge of portions of the work. The chairmen of these sub-committees are grouped into an executive committee. The following are the members of the executive committee, together with the organizations they represent: S. F. Heckert, chairman, Chamber of Commerce; Charles Bickel, Pittsburgh Chapter, American Institute of Architects; George H. Danforth, Engineers Society of Western Pennsylvania; J. Charles Wilson, Builders' Exchange League; F. S. Guthrie, Civic Club of Allegheny County; R. J. Trimble, Board of Fire Underwriters; George H. Schwan, Housing Conference, and Wayland Rupert, Real Estate Board.

Since the Pittsburgh committee is taken from among the most capable men of each organization, it is expected that the interests of the members of each will be properly conserved, especially when each representative has his organization to draw from in the matter of the desired information. Reference is also had to the standards of the various architectural, engineering and testing societies. Conferences are had with material men, contractors and public spirited citizens during the preparation of the work

The program under which the committee is working is comprehensive and is so divided up that the ordinances will appear in a logical and usable order. Each ordinance is subdivided by sections and headings in the same manner. It is expected that the code when finished will contain all the necessary information arranged in such an orderly manner that any architect, engineer or contractor can prepare and execute his work without much further reference.

The executive committee named above reviews and checks all proposed ordinances, holds meetings with those whose interests are directly affected and decides upon the final form, arrangement and contents of the ordinances before they are passed on to the committee as a whole, and thence to council.

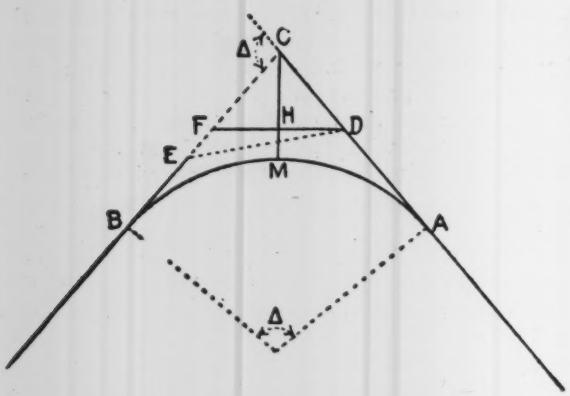
The ordinances are prepared one at a time by the secretary-engineer according to a comprehensive program which was first submitted to and adopted by the committee. The plans are strictly adhered to, and the results show this plan to have eliminated political jockeying, which insures the passage of ordinances such as a modern architect, engineer or contractor would prepare.

JOHN A. FERGUSON,
Secretary-Engineer, Building Code Committee.
Pittsburgh.

Relining Railroad Curves

Sir—I have been interested in the several solutions of the problem of how to deterine the external distance of a railroad curve when the point of intersection is inaccessible, which have appeared in recent issues of *Engineering News- Record.*

In view of the quality of men who are daily applying to this office for jobs as instrumentmen, I consider that it would be a serious proposition to ask one of them to solve two or three blique triangles in the field every time he came to a curve with an inaccessible P.I. and expect him to make any progress. So why worry the poor man with oblique triangles when the same result



can be accomplished by a practical method which only requires the solving of one right triangle?

Following is the mthod evolved in this office for use in its valuation survey, which is so simple that we refuse to believe that it is original, or to accept any credit if it is:

Produce tangents to points D and E. Measure angles CDE and CED. The sum of these angles is △, the central angle, and one of the required elements of every railroad curve. With the transit at D, turn off the angle CDF, equal to ½ (CDE + CED), forming the isosceles triangle DCF. Measure the distance DF and set the middle point H. Solve the right triangle CHD for CH. Measure the distance HM, and add it to CH, which gives the external distance.

In application this method is very flexible. For instance, if the line DF is inaccessible the transit may be moved along the tangent in either direction until a point is found where a line parallel to DF can be measured.

As to the comment of T. H. Gordon that the method would be necessarily approximate, I can say that our measurements of externals, which are always made as a check, even if we have original curve data, are remarkably close to the theoretical distance.

M. N. DUSTIN,
Chief Draftsman, Valuation Department, Chicago, St. Paul, Minneapolis & Omaha Ry.
St. Paul.

The Proper Aim of Licensing Laws

The perennial question of licensing engineers was the subject of some discerning and entertaining remarks by Prof. Adolph Meyer, University of Minnesota, in his presidential address before the Civil Engineers' Society of St. Paul. Professor Meyer said:

"Among the public questions now before committees of this society are the licensing of engineers and schedules of minimum fees for engineering work. Much may be said on these subjects both pro and con. Yet, if all men who call themselves engineers were properly trained, thoroughly experienced, pledged to coöperation with each other, and were actuated only by unquestionable motives, neither license laws nor schedules of minimum fees, nor codes of ethics would be necessary in Minnesota, or in any other state of the Union, for the protection of the public on the one hand and representative members of the profession on the other.

"A license law, of course, cannot be made retroactive, except in so far as it may require a certain number of years of practical experience prior to the passage of the act to secure exemption from its provisions. But whether we secure a license law or not we shall have a small group of incompetent men practicing the profession in every state in the Union for a good many years to come. If then, a law can be so framed as to prevent additions to this group without discriminating against capable and responsible men in the profession, it will serve a real purpose, even though such a law cannot weed out present incompetents. Incidentally, a license law may at least impress some misinformed people with the fact that an engineer must at least possess sufficient qualifications of some kind to make their enumeration—or specification—in a statute possible. The aim of a license law should be to protect the public—and of course it cannot be so framed as to avowedly protect engineers as a class, although it will operate to this end also—it should protect the public alike from the inexperienced graduate student and from the rule-of-thumb practitioner whose conclusions have no scientific basis acquired either by college training or by private study and experience in the school of hard knocks.

HINTS FOR THE CONTRACTOR

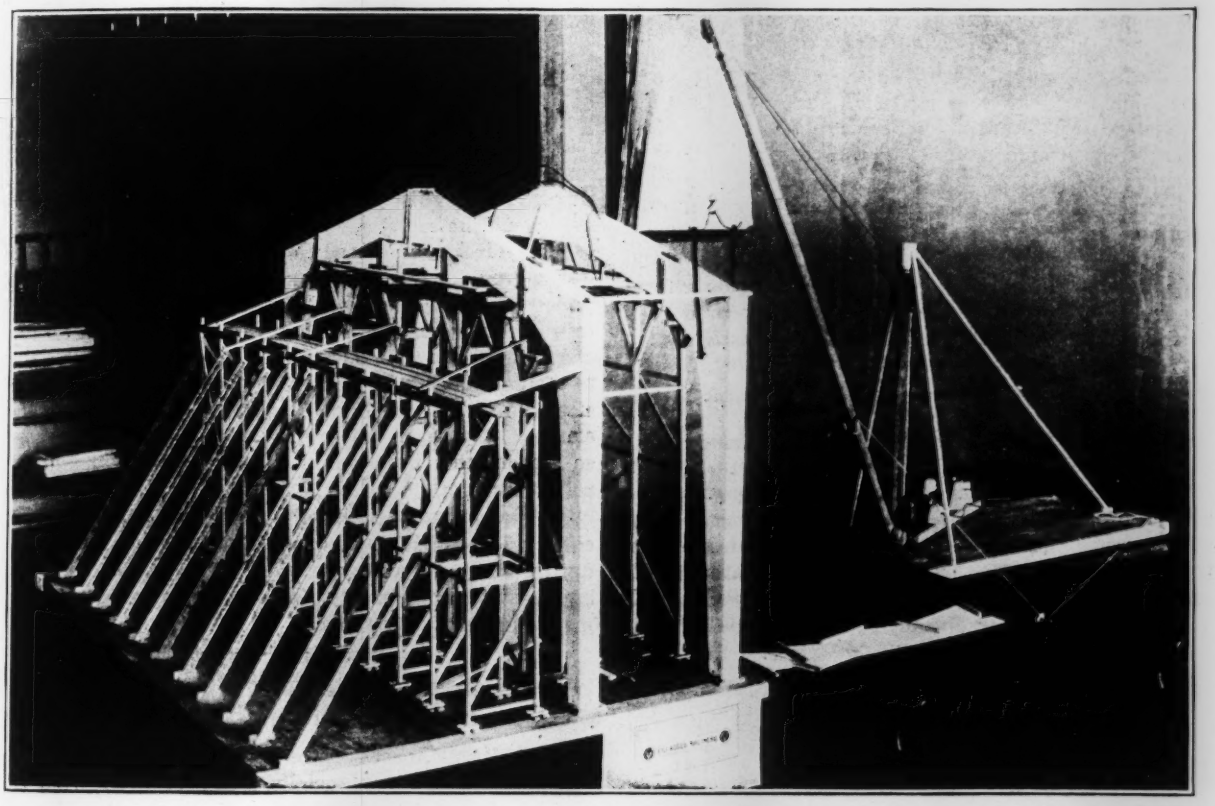
DETAILS WHICH SAVE TIME AND LABOR ON CONSTRUCTION WORK

Model of Complicated Form Makes Considerable Saving in Cost

WHERE new form construction is required, it is often found that the first part of the work is more or less experimental, and the best methods are only developed with the last bent. At least T. M. Lauridsen, who designed the unusual forms employed on the Garfield Smelter by Villadsen Brothers of Salt Lake City, so considered, and made a model of the form work with which to determine the most economical design. Mr. Lauridsen described the use of the model, which may easily have saved 10% on from work costing $11,000, in a recent *Journal* of the Utah Society of Engineers. According to his discussion, forms where both drawings and models are advisable comprise work of exceptionally large dimensions, or work in which untried methods are necessary, especially if the forms represent a considerable investment, as in the case of the Garfield foundry shown in the photograph, which has fourteen bents the same as the two shown in the model. They have a span of 69 feet and a height of 44 feet. The form is designed for use three times. The end scaffold is not only to provide a solid backbone for the whole form structure, but also for use in setting steel sash, pouring end wall, stripping and painting. The best position for the scaffold may be determined from the model so it is available for all the different kinds of work and will not have to be reconstructed for each.

By the experience gained in putting the parts together in the form of a model, almost as much efficiency can be attained on the first bent of a building as is usually the case on the last bent. For instance, before this model was constructed it was thought that it would be advisable to erect the outside scaffolding first. A study of the model developed the fact that a saving of possibly 10% in the erection of the first bent might be made by erecting the scaffolding under the bent first and following that with the end scaffold, thus allowing a clean sweep for the erection of the arch supports, which are exceptionally heavy.

Another point which was very easy to observe from the model, but was not by any means so evident from the set of drawings, was the necessity of eliminating all the diagonal sway bracing on one side of the arch scaffold so that the column forms would go into place more readily.



MODEL OF GREAT USE, NOT ONLY IN DESIGN, BUT IN GETTING IDEA ACROSS TO FOREMEN

It should be noted that the model is supplemented by a most complete and detailed set of form drawings. This method of representing the building in its whole three dimensions at one glance serves as an excellent check on the form drawings.

The handling of these little pieces with the crane has all the advantages of a moving picture, showing every operation in the construction of the building. It is possible to demonstrate the method of stripping of the forms by actually making all the moves necessary for each unit to be extricated from the maze of scaffolding. The erection of the model showed that it was advisable to determine approximately the center of gravity of each unit so that the requirements for straps and slings used in hoisting would be known in advance.

The best method of piling the form units and other materials is easily found by a little experimenting with the small derrick.

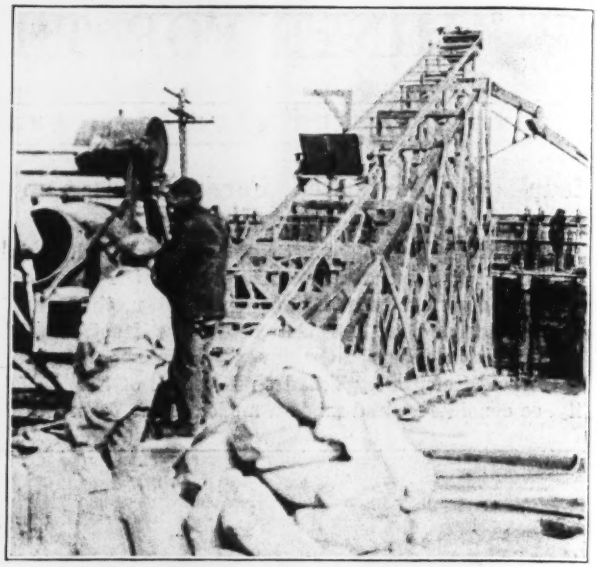
Possibly the greatest value of having the complete building represented in this manner is that it gives something tangible to assist in discussions among the various parties interested in the design and erection. It is very convenient for purposes of instruction to foremen, sub-contractors, cost keepers, and possibly other workmen who may not be familiar with plan reading.

The model represented in the photograph required 30 carpenter hours, a negligible amount of labor on a form worth $11,000, which cost might easily be latered 10% by the slightest variation in the method of handling.

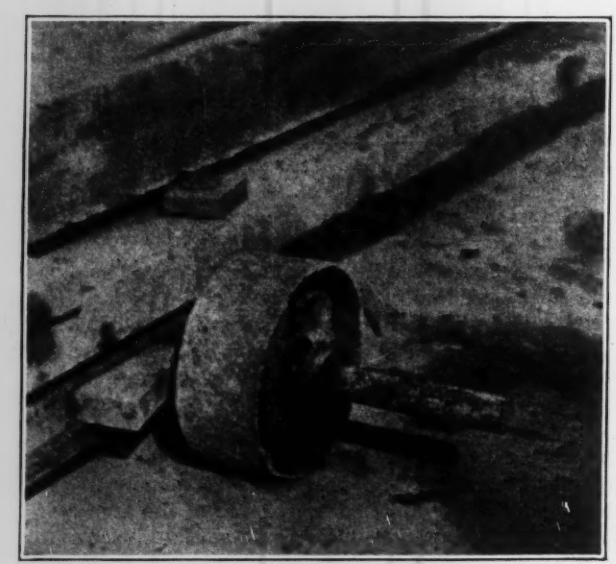
Slide Axles in Slots to Change Direction in Moving Inclined Elevators

THE small mixers with inclined elevators used in building the Highland Park reservoir described on p. (?) of this issue were moved on transverse axles with a cast wheel at each end. This provided motion in the direction of the long axis of the elevator, but it was desired on this particular work to move the elevators sidewise. The difficulty was overcome by slotting the hardwood bearings of the axles so that the axles could be set at a considerable angle with the elevator. With all of the wheels so set, when the elevator was moved forward it would also slide over sidewise. The wedges would then be reversed and the elevator rolled back, moving it still further sidewise. One of the photographs shows one of the slots with the axle pushed to the extreme forward end and a wedge inserted in the slot behind. When the photograph showing the entire elevator was taken all of the axles were shoved over so as to move the elevator to the left if it should be rolled forward.

As the chutes at the head of each elevator covered a considerable range, it was possible to move the elevators during times when they would normally have been idle anyhow without difficulty. Moving required only a few men, and was fairly rapid.



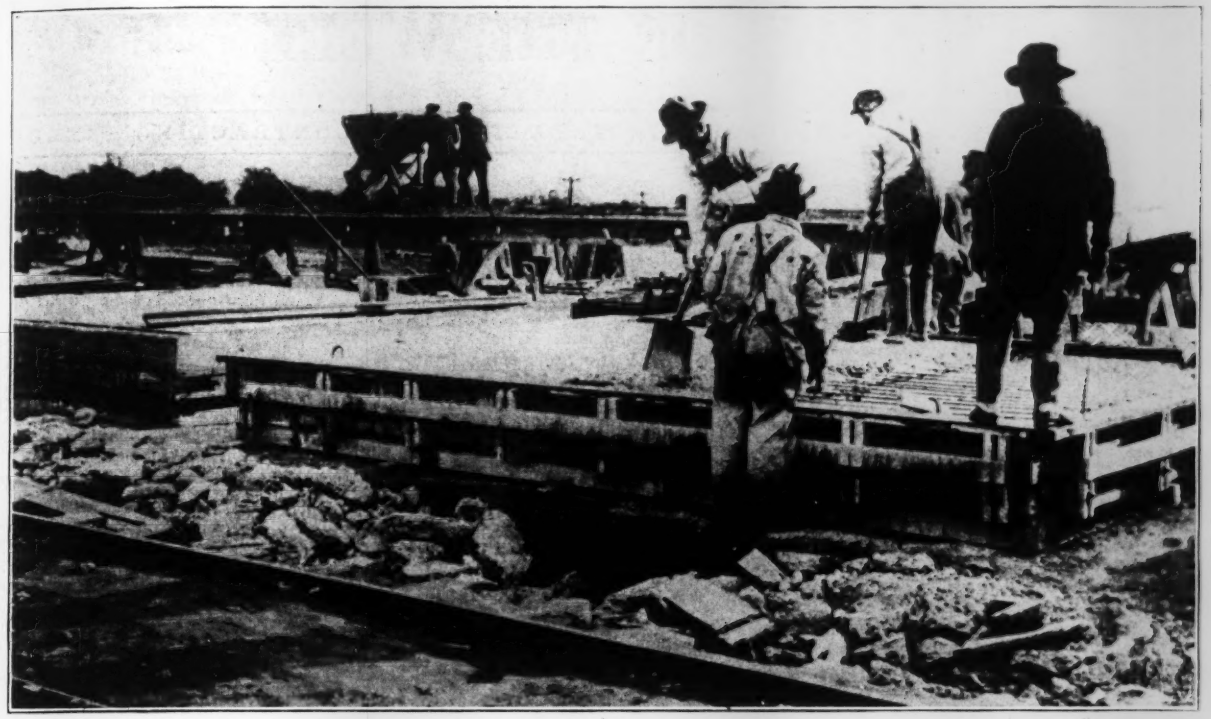
WHEELS SET TO MOVE ELEVATOR TO LEFT



WEDGE SET IN SLOT FOR AXLE UNDER ELEVATOR

Use Concrete Bases and Cantilever Side Forms in Casting House Slabs

CONCRETE bases coated with paraffin and oiled after each use materially assist accurate work in casting the slabs for the concrete workmen's houses described on page 695, which are being built by the Unit Construction Co. for the Youngstown Sheet & Tube Co. The slabs, of which 150 are used in making sections for two of the three types of houses, are employed for casting the larger sections. They are poured directly on the ground. Each is made the exact size of the sections to be cast on it, is carefully floated level and finished smooth by troweling. In the sides of each a short distance from the top are embedded ¾-in. bolts and registering with the center of each stub bolt there is a slot in the wood side forms. Once slipped over these bolts, adjusted so their tops are level with the top of the slab to be cast, and clamped, these side forms are rigidly held by the bolts, no other bracing being required. The concrete beds, which cannot warp out of shape or change in size with the



BOLTS SET IN CONCRETE CASTING PLATFORM HOLD CANTILEVER SIDE FORMS RIGID

weather, make it possible to cast a large number of slabs which are exact duplicates, which renders close fitting and rapid erection easy.

Only a few of the slabs show a tendency to stick to the concrete beds, but as all are raised by one edge with a crane there is no delay on this account. None of these slabs has shown an injured surface as a result of sticking. The tendency has been overcome in each case of oiling the bed a little more carefully next time. The paraffin coat applied to each bed at the start has prevented any absorption of water from the concrete.

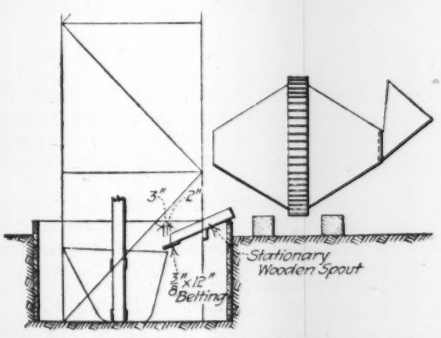
The work is being done by the Unit Construction Co. for the Youngstown Sheet & Tube Co.

Flap of Belting Better Than Automatic Stop on Concrete Tower

By John T. Sullivan

Roos Bros., Engineers and Concrete Contractors, Cincinnati, Ohio.

A FLAP of leather belting nailed on the end of a wood chute to extend it over the edge of the concrete bucket in the hoisting tower has been found in the writer's experience to work better than the automatic section of chute generally used, which moves in such a way as to clear the bucket when being hoisted or lowered. Occasionally the automatic stop fails to work properly and the bucket strikes its projecting end when being lowered and wrecks it, causing delay.



BELTING ALLOWS FREE PASSAGE OF BUCKET

The flap device is made by placing a stationary wood chute from the mixer to within a couple of inches of the bucket. At the end of this spout a piece of ½ x 12-in. leather belting is nailed to the under side of the wood so as to project about 5 in. beyond its end. The belting is sufficiently stiff to discharge the concrete into the bucket and at the same time is flexible enough to allow the bucket to move up and down without difficulty.

Big Fire Loss on National Forests

Forest fires burned over 962,000 acres of national forest lands in 1917 and caused a loss of $1,358,600 to the Government in timber, forage, and young growth, according to figures compiled by the Forest Service. While the loss was larger than for several years past, officials say that, considering the unusually dangerous conditions, it was remarkably light. Protracted drought and periods of high winds made the conditions, they declare, virtually the same as in 1910, when many persons were burned to death and $25,000,000 worth of timber on the national forests was destroyed. In addition to the actual loss, the fires of last year entailed extra expenditures by the Government of $1,121,451. This, it is pointed out, means that to hold the fires down large numbers of men have to be withdrawn from productive work and much money spent for supplies. The Forest Service officials are emphasizing the criminal wastefulness of forest fires that can be prevented and are urging greater care.

NEWS OF THE WEEK

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

Plans Made for Water-Works Convention at St. Louis

Plans for the 38th annual convention of the American Water-Works Assn., to be held at the Planters Hotel in St. Louis, May 13-17, include the exhibition of drawings, catalogs and photographs, but no exhibits of heavy materials will be made, owing to freight conditions. The publication committee is preparing a program which will be issued soon.

On "Superintendents' Day" the principal topics will be cold weather troubles; increased consumption of water, thawing frozen services and protection of fire hydrants; and office records. A questionnaire on these subjects will be prepared soon by the subcommittee in charge of "Superintendents' Day."

Important committee reports are expected, especially from the committee on depreciation and the committee on revision of standard specifications for cast-iron pipe and specials. The special advisory committee on revisions to the constitution has reported to the executive committee and the amendments suggested will be submitted for final action by the convention.

Kansas City Votes $1,250,000 Water Bonds

Bonds to the amount of $1,250,000 for a new water-works pumping station and 22,000 ft. of gravity flow conduit leading to it were approved Apr. 2 by the electors of Kansas City, Mo. The vote stood 33,583 to 2,858. It is reported that the water bond issue will be supplemented by funds taken from the revenue of the water department. Detailed plans for the improvements have not yet been completed. Burton Lowther is chief engineer of the water department.

May Extend Hudson Tube Line to Meadows Shipyard

Plans have been prepared to extend the facilities of the Hudson & Manhattan R. R., which now connects New York City under the Hudson River and across the Hackensack Meadows with Newark, N. J., to the shipyard district which has grown up in the past year on the meadows. The plan at present contemplates the extension of the line of the Pennsylvania R.R. from near its Meadows shops to the entrance of the Federal Shipbuilding Co. on the Lincoln Highway at the Hackensack River. Over this extension the trains of the Hudson & Manhattan R.R., which use the Pennsylvania tracks in that section, will run from New York to the new terminal, alternating with trains to Newark.

This extension will serve the Federal yard, the Foundation Co. shipyard, the engineer depot and the contemplated Ford shipyard. It should remove the housing difficulty of this section, as it will put the whole of Jersey City, Hoboken and Greater New York within a half hour's ride of the yards. Further street-car connection must be built from Newark to tie up the Submarine Boat Corporation shipyard at Port Newark, which will not be served by the Hudson tube extension.

At present the scheme is in conference at Washington and no definite decision has been made by the interested government bureaus, that is, the Railroad Administration and the Shipping Board.

Small Activated-Sludge Plant Proposed at Chicago

Plans for an intercepting sewer are being made and plans for an activated-sludge plant are proposed by the Sanitary District of Chicago to treat the sewage from Melrose Park, Maywood, River Forest and other villages having a total population of 30,000, which is now polluting the water of the Des Plaines River.

The sewer would be about three miles long, 2 to 5 ft. in diameter, with a capacity sufficient for the dry-weather flow from a population of 150,000. Electrically operated pumps would deliver the sewage to an activated-sludge plant with capacity for a population of 30,000. The effluent would be discharged into the river. The cost of the project is estimated at $750,000, but permission for this expenditure has not yet been obtained. The work is under the direction of George M. Wisner, chief engineer of the Sanitary District of Chicago.

Building Construction Tied Up by Kansas City Strike

The building and street railway industries of Kansas City, Mo., and every other industry dependent on union labor was tied up by a strike which began about Mar. 28 with laundry wagon drivers who demanded increased pay. Construction work was stopped indefinitely, including work on the $2,000,000 power house of the Kansas City Light and Power Company.

No Bridge Across Hudson River with Intermediate Pier

Governor Whitman of New York on Apr. 9 signed the Sage-Welsh bill to prevent the erection by the New York Central R.R. of a bridge with an intermediate pier in the Hudson River near Castleton.

Inland Waterways Regiment Being Recruited

Men Familiar with Canal Operation Wanted for Service in France as Engineer Troops

Engineer troops are wanted in France to help to operate the canal systems there being used in the war transportation service. To this end a new regiment, known as the 57th Engineers (Inland Waterways Regiment) is being recruited under Col. James F. Bell, of the Corps of Engineers, U. S. A., who has his headquarters at Laurel, Maryland.

The official call for recruits is as follows:

"This opportunity not only to see and travel on the rivers and canals of France but to gain first hand experience in operating a system that is a model is one that will appeal to many young Americans, as well as to those who have had years of experience on our own waterways. They will see here not only an opportunity to serve their country but an opportunity to serve her in the line in which their experience will make their work most valuable. Bargemen, teamsters, saddlers, sailmakers, riggers, blacksmiths, ship carpenters, steersmen, hoisting engineers, marine gasoline engineers and a few clerks will be needed.

REQUIREMENTS FOR ENLISTMENT

"The requirements for enlistment are the same as for recruits in general with the added requirement that men must have experience as outlined above. An applicant should apply for the 57th Engineers (Inland Waterways Regiment) at the nearest recruiting station and give his age, address, trade and years of experience with name of present and of a previous employer. Men who are not within the prescribed age limits or who cannot pass the usual physical examination for recruits need not apply. Drafted men may have an opportunity later to transfer to this regiment but they cannot enlist for it now and they are requested not to write about it as no exceptions can be made and no places held open. Enlistments must be made in the grade of private, but as there are thirty men in each company of the grade of sergeant or above and twenty-nine in the grade of corporal the opportunity for promotion will be excellent for good men of experience.

"Recruiting officers have authority to enlist qualified men for this regiment without approval by the colonel of the regiment. Further information can be obtained, however, by application to Col. James F. Bell, Engineers, N.A., Laurel, Md."

Labor Department Housing Bill Passes House

The second Government housing bill passed the House of Representatives Apr. 2 and is now before the Senate. This bill, as amended, provides for an appropriation of $60,000,000 "for the purpose of providing housing, local transportation and other community facilities for such industrial workers as are engaged in industries connected with and essential to national defense." The money is to be spent under the direction of the Secretary of Labor, who has already formed a special housing division under Otto M. Eidlitz, to carry on the work. As originally introduced the bill carried an appropriation of only $50,000,000, but was amended as noted with the provision that $10,000,000 shall be spent on homes for war workers in the District of Columbia.

After the bill passed the House it was found that it did not appropriate the allotted sum but only provided for its future appropriation. It is announced that a revised bill will be immediately introduced.

The sum provided in this bill is in addition to the $50,000,000 appropriated for housing shipyard workers under direction of the Shipping Board.

B. M. Baruch, of the War Industries Board, testifying before a House committee on Apr. 8, asked for an additional appropriation of $10,000,000 for housing ordnance workers. It had been heretofore understood that the bill now before Congress covered that field.

Government Wants Assistant Sanitary Engineers

The U. S. Civil Service Commission announces for May 7 an examination for assistant sanitary engineer for men. Vacancies in the Public Health Service at $1600 a year will be filled from this examination. The duties will be to make studies of public health matters involving engineering problems, including stream-pollution and sanitary surveys, the treatment of water, sewage, and industrial wastes, and other similar subjects. Competitors will not be required to report for examination at any place, but will be rated on physical ability, 10; education, training, and experience, 90. Applicants must have been graduated from a college or university of recognized standing, with instruction including full courses in sanitary engineering, and have had at least one postgraduate year of laboratory or field experience in some branch of sanitary engineering; or have had at least two years' competent experience in sanitary engineering; or a combination of education and experience as outlined above aggregating three years. Special credit will be given for training in antimalarial measures or supervisory experience in ditching or drainage. Applicants must not have reached their forty-fifth birthday on the date of the examination. Further information may be obtained from the commission, Washington, D. C.

Government Makes Progress in Concrete Boats

Big Ship Program Put Up to Congress by Shipping Board—Navy to Build 500-ton Barges

(Washington Correspondence)

Concrete ship and barge plans in Washington are progressing. The Shipping Board, through the medium of the *Official Bulletin* and newspaper interviews, the latter not necessarily authentic, announced progress toward large ship construction and the expediting of plans for the operation of Government yards. In the matter of smaller vessels the Navy Department received bids for twelve 500-ton concrete barges for use in several navy yards.

The original plans of the Shipping Board contemplated the letting of three and possibly four contracts for the construction of 3500-ton concrete ships to private parties who would submit their own designs, to be checked by the Shipping Board, and who would build the ships under the Board's direction. In addition, the Board designed a ship of its own, the construction of which was to be let to some contractor. With these several experimental vessels to judge from, the Board would then proceed to develop a standard ship which would be built in large numbers, provided the experiments proved successful.

On this program three contracts were let for 3500-ton ships, as noted in these columns at the time. Work has been started on the ways of one of these ships, but the two others have not got beyond the design stage. On account of the delays incident to checking over the designs of the vessels submitted, the Board is now disposed to discard this method of construction and to proceed more strongly than contemplated to build ships of its own design.

Accordingly, the Board will locate three and probably five yards for building concrete ships, these yards to be owned by the Government and to be used for the construction, by contract, of Government designed ships. While the first ships will undoubtedly be the 3500-ton freighters already designed by the Board, design of a 7500-ton boat will be immediately started. Contracts are also about to be completed with the San Francisco Shipbuilding Co. for 7500-ton ships in its yard, where the 5000-ton "Faith" was launched recently. Engines for the 3500-ton boat —designed and built for the Government's 3500-ton wooden boat—will soon be available. Equipment for a 7500-ton boat must be designed and built and could hardly be ready for some time, so that starting a 7500-ton ship now would not avail much.

In pursuance of the Board's scheme, on Apr. 8 Chairman Hurley announced that the Shipping Board would request a special appropriation of Congress of $50,000,000 for the new program. It is believed no opposition will develop and the money will soon be granted.

The Navy Department barges are to be used at the navy yards at Boston, Brooklyn, Philadelphia, Norfolk and Charleston. Specifications were sent to 35 firms and 10 submitted bids, which will be opened about Apr. 17. The advertisement asked bids on twelve 500-ton (dead-weight cargo) reinforced-concrete harbor barges, to carry coal on deck within flashboards and oil in compartments below deck within the hull. Bidders were requested to submit their own designs, there being certain restrictions as to freeboard, unit stresses, strength, etc.

To Safeguard Labor Interests in Limiting Capital Issues

To reduce the possibility of local unemployment arising from limitations on building and capital expenditures, the Federal Reserve Board's Capital Issues Committee has arranged to consult with officials of the American Federation of Labor and the United States Employment Service before disapproving or approving issues of securities which would seriously affect labor conditions. Where it appears desirable to curtail or prevent construction, even at the expense of throwing men out of work, special effort will be made to transfer unemployed laborers to other work.

Frank Morrison, secretary of the Federation of Labor, and John B Densmore, director of the Government Employment Service, will act as unofficial advisers to the Capital Issues Committee.

War Labor Board Appointed

Creation of a National War Labor Board to adjust all labor disputes during the war was proclaimed Apr. 9 by President Wilson, with its members the same men who recently framed the labor policy of the Government for the war period.

The board is headed by ex-President Taft, selected by employers, and Frank P. Walsh, selected by employees, representing the public.

Emergency Fleet Corporation Needs Chief Clerks

Need of men to fill positions as chief clerks is announced by the United States Shipping Board, Emergency Fleet Corporation, through John M. Goodell, employment manager. The corporation needs about half a dozen men of considerable executive capacity of a certain kind, who will go into the general offices of the Emergency Fleet Corporation at $1500 a year, and be trained to become chief clerks of divisions. The promotion for the good men is generally very rapid, rising first to $1800 when they are tried out as chief clerks, then rising to $2000, $2200 and $2400 as they show capability and the positions become vacant.

These men in their offices of chief clerk generally begin work at half past eight in the morning and work to about half past six every day, with the proba-

bility that they will be called on for Sunday work from time to time, and the further probability that in some of the divisions they will have to work about half of their evenings to ten o'clock or to midnight. The corporation announces that the work to be done by these men, who are needed badly by the government, is very important in a certain sense.

Ontario Dam Fails and Puts Burden on Niagara Power

On March 9 a section 125 ft. long slid out of the Springbank concrete dam, on the Thames River about five miles below London, Ont., putting out of service the 500-hp. electric station there and throwing that much more burden on the Niagara Falls hydro-electric plants which are already loaded far beyond their capacity.

The London dam was built about 19 years ago to provide for a power station supplying the water-works with electricity. Since early spring the river has been in flood and some time ago a breach developed under the dam which gradually widened and culminated in the failure. An investigation is in progress.

May Change Office Hours to Cure Washington Street Congestion

The ever-increasing number of government employees in downtown Washington some time ago taxed the street car system beyond its capacity. This will lead to a radical readjustment of governmental business hours if a recommendation of John F. Beeler, traffic expert for the Public Utilities Commission of the District of Columbia, is adopted. Mr. Beeler's suggestion proposes advancing the hour of opening a number of the government departments from 30 min. to one hour, and changing the closing hour similarly. That is, some of the departments will open at 8, others at 8:30, others at 9 and others at 9:30, ending their officials day 7½ hours after their opening in each case, with a half-hour lunch period. In this way it is hoped to distribute the peak load not only on the street cars but also in the streets, which are today in downtown Washington crowded to an unheard of condition in that hitherto roomy city.

Goethals and Company to Supervise Works in Louisiana

George W. Goethals & Co., Inc., New York, have been retained as consulting engineers by the Dock Commission of the Port of New Orleans to locate, design, and supervise the construction of an industrial canal and locks connecting Lake Pontchartrain with the Mississippi.

The Capital Issues Committee of the Government has approved the bond issue of $3,500,000 to begin preliminary work.

George M. Wells, a member of the firm and one of the principal assistants to General Goethals on the Panama Canal, will be in charge of the work.

Lower Costs, Higher Wages and Shorter Hours

Discussion at Chicago Conference Deals With Present and Future War Labor Conditions

At a conference held in Chicago Mar. 27-29, under the management of the Society of Industrial Engineers and the Western Efficiency Society, the proceedings and discussion related almost entirely to war labor conditions from the point of view of conserving the available supply of labor and of securing a maximum production. Emphasis was laid on the after-war condition which, it was asserted by Harrington Emerson, consulting engineer, would involve lower costs with higher wages and shorter working hours. Readjustment after the war to take care of men returning to civil employment, and especially to take care of those who are crippled and disabled, was the subject of a series of papers.

Higher Wages and Shorter Hours

Mr. Emerson took the position that the universal aim must be to reduce costs; that as costs go down, wages will rise, and as men become more prosperous and attain a high standard of living, they will demand shorter working periods. It was said by Mr. Emerson that the employer should recognize this coming change and adapt himself to it for his own interest as well as that of his employees.

The position of women in industry, particularly in replacing men under present and future conditions of labor, was dealt with in another series of papers and addresses. Some of these discussed the varied kinds of labor—light and rough—which are now being undertaken by women. C. E. Knoeppel, New York, presented a report based on the replies to a questionnaire sent to 100 employers, mainly manufacturers. He considers that women are needed in industry, and that their employment will not be detrimental to organized labor. Employers in general agree that women taking the place of men should receive the same pay as the latter, so that there would be little inducement to discharge men for the sake of employing cheaper labor. In the heavier industries Mr. Knoeppel considered that man-power should be utilized as much as possible before introducing women.

Wasteful Labor Shifting

It was pointed out that much time and energy are lost through men moving from place to place, owing to employers competing with one another for the men required. In Mr. Knoeppel's opinion manufacturers and labor unions should coöperate to stabilize wages and prevent this wasteful shifting of labor. Other speakers referred to methods of training men in their work, providing comfortable working and living conditions and encouraging permanent employment. At Rochester, N. Y., when a large supply of labor was needed for new war industries, it was considered highly undesirable to take men away from established plants. The local labor agency advertised and circularized in towns and villages within a 150-mile radius, pointing out the offers of employment and the advantages of the city as a place of residence. This worked well, since it attracted many men who probably had often thought of such a move, and who were stimulated to take this step by the direct offer of employment.

Col. A. D. Kniskern, U. S. A., described the great development of the U. S. quarter-master depot at Chicago to meet war conditions. The force has increased from 3 officers and 40 civilian employees to 96 officers and 2500 employees, besides 300 inspectors. The office and warehouse space has increased from 35,000 sq.ft to 2,500,000 sq.ft. The purchases amount to $25,000,000 per month. The methods employed in the ordering, acceptance and payment for goods was explained, and Col. Kniskern pointed out the reasons for these methods.

Changes in Engineering Personnel at Hog Island

A number of changes in the directing engineering personnel of the American International Shipbuilding Corporation which is building and operating the Government agency shipyard at Hog Island, Philadelphia, have recently been announced. Frederick Holbrook has been elected vice-chairman and managing director of the corporation and will act as the chief executive officer, though Dwight P. Robinson remains as president. Mr. Holbrook is a member of the Boston contracting firm of Holbrook, Cabot & Rollins and is a vice-president of the American International Corporation. Ira W. McConnell, chief engineer of Stone & Webster, has been made works manager of the shipyard, succeeding Thomas A. Carr, and O. G. Dale has been made chief engineer succeeding G. H. Manning. E. C. Macy is the new transportation manager, in place of H. G. Oviatt, and will continue in charge of the materials distribution department.

In the ship construction work the engineering heads are L. D. Lovekind, fabricating manager; G. L. Gillette, manager of hull fabrication; C. C. Thomas, manager machinery fabrication and H. L. Lowe, fabricating engineer. The manager of ship construction is J. T. Martin.

Chicago Engineers Want Technical Man to Head City Shops

Chicago Engineers on Apr. 4 protested to the Civil Service Commission against placing the municipal shops in charge of a layman instead of a mechanical engineer. If the commission places the position under "supervising service," it is feared that it may be filled by a politician. An emergency committee, consisting of W. H. Finley,

Shall the Civilization of the Ages vanish before the Devilization of the Hun?

One hundred million freemen answer

NO—

James N. Hatch, Isham Randolph, T. B Lambert and Harold Almert, was appointed by the American Association of Engineers to appear before the commission, which, contrary to the desires of the Department of Public Works, has placed the position in "supervising service" rather than "engineering service."

In the opinion of John E. Ericson, city engineer, no person except an engineer can fill this position properly. He holds that classifying it outside of the engineering service is not for the best interests of the city, and certainly is a direct blow to the city's engineering service. If the engineers in the lower grades are not given the opportunity to compete in examination for the better positions considerable incentive to good work is removed.

Technical Students Wanted for Summer Work

Opportunities for valuable service to the Government during the summer vacation are open to undergraduates in technical schools, according to a bulletin just issued by the Federal Board for Vocational Education. The statement is as follows:

"Most of the younger technical men from three branches of Government service—the Reclamation Service, the Bureau of Standards, and the Geological Survey (topographical branch)—have been detailed for special war service either here or abroad. The draft has cut off from these branches their usual supply of new men. This leaves the personnel of these departments so depleted that it is almost impossible for them to do their regular work; only with difficulty can they supply men needed for the Army.

"In this emergency the Government calls upon the technical students of the country. From May 1 to Oct. 1 there is much work in these departments that can be performed by undergraduates with technical training. Those particularly desired are young men of good physique who are below the draft age, and those members of the enlisted reserve who will not complete their college work before October, 1918.

"For the Bureau of Standards.—Not less than one year of work of college grade in physics and mathematics. (Special mechanical and testing skill is desirable.)

"For the Reclamation Service.—Not less than one year of work of college grade in civil engineering and surveying.

"For the Geological Survey.—(Topographical branch)—Not less than one year of work of college grade in civil engineering. (Special work in map making is desirable.)

"Men with drafting ability and experience are also particularly desired. These indicate the minimum requirements; additional qualifications will lead to better paid positions."

Further information may be obtained by writing to one of the following department heads, Washington, D. C.: Dr. George Otis Smith, Director, Geological Survey, Department of the Interior; A. P. Davis, Director, Reclamation Service, Eighth and E Sts.; Dr. W. S. Stratton, Director, Bureau of Standards.

Light Railways Replacing Motor Trucks

War Correspondent Writes of Observations Back of the British Lines

Recent letters received from R. K. Tomlin, Jr., war correspondent of *Engineering News-Record*, written (as a report to the editor) after a visit to the British front, will be of interest to readers:

"Am too busy to write more. Will give you full details of British front trip when I can find time. A Bouche plane shot down almost over my head. Fell in a sheet of flames. "Tin hat" and gas mask no novelty to me now. Off for Lyons next week—seems tame after what I've been through.

"Was very interested in your hint at an English trip. This looked pretty good to me—but *not right away*. There's more stuff to be picked up here. The chief difficulty thus far has been this: The U. S. Army's work until very recently has been almost entirely on paper—organizing, planning, etc. Naturally this stuff doesn't make a hair-raising story. But the real field work is beginning to come along by degrees now.

DON'T STAY LONG IN PARIS

"Your letter was most encouraging and helpful and has given me a new stimulus in my work. Have just received copy of *Engineering News-Record* containing my road story and am glad to know you liked it. All these little souvenirs from home are most cheering, for a fellow gets the blues every now and then over here. It's a rather lonely life, for the friends I make at the University Union are practically all officers who come there, stay a few days and then depart for their stations in the field, after which I never hear of them again. The Army is moving all of its departments out of Paris, but I think it best for me to continue my headquarters there, for the present at least, as it is the most central point from which to travel.

"Had a wonderful week on the British front and as soon as this Lyons Fair business is over I will send you a real story on light railways (with pictures) which have practically superseded highways for the delivery of everything to the front. Scores of *idle* lorries *parked* along the sides of the roads told an eloquent story of what the light railways are doing in taking traffic off the roads. The British are splendid fellows and I never received such hospitality anywhere before. They couldn't do enough for me.

"Tell H—— this town is smokeless. In every tobacco shop this sign: "Rien a Fumer;" or this, "Mille Regrets! Pas de Tabac, Pas de Cigarettes. Inutile d'insister!"

"No good to send cigs. from states, as they pinch all of them. Am puffing on a rank French weed now and even my stock of these is about exhausted."

E. Longstreth Medal Awarded to Levi Talbot Edwards

The Franklin Institute has recently awarded its Edward Longstreth Medal of Merit to Levi Talbot Edwards, Philadelphia. This award was made in recognition of Mr. Edwards' work in devising the Talbot compound air-lift system and developing it to such an extent that it has become an effective method of raising water.

Milwaukee Water Purification

An appropriation of $30,000 for experimental work in filtration and other means of purification of water has been made by the Common Council of Milwaukee. An engineer is to be appointed to direct the work, which will probably extend through a year. H. P. Bohmann is superintendent of water-works.

Water-Purification Chemicals Freed From Embargo

Liquid chlorine, alum, sulphate of iron and similar chemicals, when they are to be used in purifying public water-supplies and are consigned to municipalities, have been freed from embargo by the priorities section of the office of the Director-General of Railways. An order has also been issued which exempts from embargo empty metal, glass or jacketed oil, acid, gas or ammonia containers. These orders will relieve the conditions detailed on pp. 685 and 688 of *Engineering News-Record*, April 4. The results of a canvass of priority orders in relation to general supplies for water-works construction and operation is given on p. 743 of this issue.

ENGINEERING SOCIETIES

At the meeting tonight of **The Montreal Branch of the Canadian Society of Civil Engineers**, W. Chase Thomson will present a paper on "The Kettle Rapids Bridge," giving the reasons for his adoption of the unusual design (1000 feet continuous girder in three spans) and describing the interesting construction methods used and the difficulties successfully overcome in the erection of this far northern bridge. Norman Holland will speak on "My Views (illustrated ones) on Varnish Manufacture." Mr. Holland is a chemist as well as a manufacturer.

The Brooklyn, N. Y., Engineers Club will meet this evening to hear a paper on "Safety of Life and Property at Sea," by William T. Donnelley, past president of the club. On Apr. 16 George C. Whipple, also a past president of the club, who returned recently

Calendar

Annual Meetings

AMERICAN WATER-WORKS ASSOCIATION; 47 State St., Troy, N. Y.; May 13-18, St. Louis, Mo.

AMERICAN ASSOCIATION OF ENGINEERS; 29 South La Salle St., Chicago; May 14, Chicago.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS; 29 West 39th St., New York; Spring meeting, June 4-7, Worcester, Mass.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS; 129 York St., Brooklyn, N. Y.; June 19-22, Berlin, N. H.

AMERICAN CONCRETE INSTITUTE; 27 School St., Boston; June 24-26, Atlantic City, N. J.

AMERICAN SOCIETY FOR TESTING MATERIALS; University of Pennsylvania, Philadelphia; June 25-28, Atlantic City, N. J.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS; 29 West 39th St., New York; Atlantic City, June 26-28.

from Russia, will speak on "Russia and Roumania in War time"; on Apr. 25 Frank C. Hurd will address the club on "Concrete Ships," and on May 2 John C. Knox, assistant U. S. district attorney, will describe how the government deals with enemy aliens.

"The Technical Mind and the City Plan" was the subject of the address delivered Apr. 8 before the **Louisiana Engineering Society**, New Orleans, by C. A. Favrot.

At the meeting of the **Engineers' Society of Milwaukee**, Milwaukee section of all National Engineering Societies, held under the auspices of the Milwaukee section of the American Society of Refrigerating Engineers, April 10, Charles L. Fortier, chief engineer of the Johnson Service Co., gave an illustrated talk on "Automatic Control Apparatus for Temperature Control in General, and Also as Applied to The Refrigerating Industry."

On Saturday afternoon, Apr. 27, the **Harvard Engineering Society of New York** will visit the shipyards at Newark, N. J., to observe the progress of the Government's shipbuilding program. The shipways, the shops and the Port Newark Terminal yards will be inspected. The annual meeting of the society will be held the same evening at the Harvard Club, New York.

At the regular meeting of the **Engineers' Club of Philadelphia** to be held Apr. 16, the address of the evening will be made by Dr. Morris Jastrow, Jr., librarian of the University of Pennsylvania and professor of Semitic languages, on "The War and the Eastern Question." The paper will be illustrated with lantern slides.

James R. Rumsey was elected president of the Grand Rapids, Mich., Engineering Society, Mar. 27. H. H. Turner, director of the society, has collected for the Red Cross 350 yards of washed tracing cloth to be used for medicinal purposes. Byron F. Parks spoke on "Is a Membership in the Engineering Society Worth While?" and Lee H. Bierce told of the relationship the Engineering Society held with commercial bodies.

Forty civil engineers of Wyoming met in Cheyenne, Mar. 19 to perfect a state organization. They represented all sections of the state. G. J. Schenck, of Basin, acted as temporary chairman and C. W. Skinner, Cheyenne, served as temporary chairman. Among the features of the meeting was a visit to the filter system and other parts of the Cheyenne water-works.

The Detroit Engineering Society met Apr. 5 at the Detroit Board of Commerce and listened to an address by Bamlet Kent, a member of the society, on "Dredging Work and Straightening of the River Rouge," and also on "Copper Mining." The annual meeting of the society will be held Apr. 27. The results of the election, by mail ballot, of officers of the society will be announced. The speakers of the evening will be Maj. Gen. Charles M. Clement, Col. W. C. Capels, 310th Engineers, and Capt. Robert Lausell, Engineers' Reserve, French army.

The nominating committee of **The Engineers' Society of Pennsylvania** has made the following nominations for the term beginning June 17: President, C. A. Emerson, Jr.; secretary, Howard E. Moses; treasurer, W. Grant Ranch. C. A. Emerson, Jr., is a graduate of the Massachusetts Institute of Technology in the sanitary engineering course, and was employed by the City of Baltimore for a number of years on the new water-works improvement. Mr. Emerson succeeded F. Herbert Snow, now chief engineer of the Public Service Commission of Pennsylvania, as chief engineer of the Pennsylvania State Department of Health, two years ago. The ballot is now being canvassed and the results will be made known at the meeting of May 13.

Sergeant B. A. Andrews, of the Argyll and Southern Highlanders, who has been two and a half years at the front, addressed the members of **The Chicago Engineers' Club** at a luncheon Apr. 3.

PERSONAL NOTES

JOHN N. MACKALL, formerly engineer of surveys for the State Roads Commission, Baltimore, Md., and at present office engineer of the Pennsylvania State Highway Department, has been appointed chief engineer of the Maryland State Roads Commission, succeeding Henry G. Shirley. Mr. Mackall has been engaged in highway engineering work since 1905, following his graduation from Maryland State College. He was born at Mackall, Md., 32 years ago. His first engagement was with the highway division, Maryland Geological Survey, and he remained in the service of his native state until February, 1917, when he became connected with the Pennsylvania department, in charge of surveys, plans, estimates and bridges.

MAJ. WARREN R. ROBERTS, Quartermaster R. C., has been promoted to lieutenant-colonel, Quartermaster Corps, N. A. Lieut.-Col. Roberts was formerly president of the Roberts & Schaefer Co., consulting engineers and contractors, Chicago. He is at present executive officer for the constructing branch of the construction division of the U. S. Army.

GEORGE T. SLADE, vice president in charge of operation, Northern Pacific Ry. Co., having accepted a commission as major in the railway transportation corps, U. S. A., has received an indefinite leave of absence. John M. Rapelje is appointed acting vice-president in charge of operation. A. M. Burt, formerly chief engineer maintenance of way, is appointed acting general manager, lines east of Paradise, vice Mr. Rapelje. The office of chief engineer and chief engineer maintenance of way will for the present be consolidated, in charge of H. E. Stevens, chief engineer.

ALBERT A. ORT, assistant engineer for the Miami Conservancy District, Dayton, Ohio, has become a civil engineer in the navy with the rank of ensign.

GEORGE M. ZIMMERMAN has been elected city manager of Sandusky, Ohio, to succeed George T. Lehner, who resigned after serving a year. Mr. Zimmerman has been city treasurer of Sandusky for about a year.

F. A. SEETE, conservator of forests of the Imperial Forest Service of India, has been detailed to study lumbering and forest engineering in the United States. The main object of his visit is to secure first hand knowledge of the logging and milling methods used in the larger logging operations of the United States, in order that such methods may be installed in the National Forests of India, thus securing increased production to meet increased needs. The Forest Service, at the request of the British Government, is cooperating with Mr. Seete, and has arranged with the lumbermen of the Pacific Coast for an inspection of logging and milling operations in California, Oregon and Washington. Mr. Seete, who is now in New Orleans, expects to reach San Francisco about April 30.

RICHARD B. CHILLAS, for the past nine years chemical engineer with the United Carbon Co., Cleveland, Ohio, has become chemical engineer in the research laboratory of the Frankfort plant of the Barrett Co., Philadelphia.

WILLIAM S. MOORE, former city engineer of Grand Rapids, Mich., now state highway engineer of Indiana,

has been made secretary of the Indiana state highway commission.

E. M. ROHRBOUGH, Omaha, has been engaged to make a complete survey of Ord, Neb., and a map and plan for proper grading of the city.

CAPT. HARRY B. DOUGLAS, Quartermaster Corps, U. S. A., has been assigned to special duty with Maj. William B. Gray, in charge of the construction of government storage depots near Harrisburg, Penn. Mr. Douglas was formerly associated with Major Gray when the latter was general construction engineer for Kerbaugh & Co., railroad contractors and bridge builders. Since 1905 he has been with the Pennsylvania State Highway Department and was granted leave of absence to accept a commission in the Quartermaster Corps.

J. E. MCDANIEL, city manager, Montrose, Col., has resigned and will devote his time to farming.

R. A. STEINHAGEN, county surveyor and city engineer of Cudahy, Wis., has resigned to join the Twenty-ninth Engineers at Camp Devens, Massachusetts.

WATSON G. HARMON, special sanitary engineer, Department of Public Service, Toledo, Ohio, has been commissioned as captain in the sanitary corps, National Army, and ordered to report at Fort Oglethorpe, Georgia.

W. L. STEVENSON, assistant engineer in charge of the sewage disposal division, department of public works, Philadelphia, has received a leave of absence from the city, to take up war work with the U. S. Shipping Board at Washington, under the direction of Maj. Philip S. Doane, director of health and sanitation. Mr. Stevenson has been in the Philadelphia Bureau of Surveys for twenty years and has been in charge of the sewage disposal division ever since its inception more than ten years ago. His new position is that of sanitary engineer, department of health and sanitation, United States Shipping Board.

DR. B. FRANKLIN ROYER, who has been chief medical inspector in the Pennsylvania State Department of Health, has been appointed by Governor Brumbaugh as acting commissioner of health, succeeding Dr. S. G. Dixon, deceased.

R M. MARK, formerly of Spencerport, N. Y., is now connected with the Miami Conservancy District, Dayton, Ohio.

J. H. HOSKINS has been appointed county surveyor of Stanislaus county, California, to succeed Edgar H. Annear, who is now a captain in the Twentieth Engineers, U. S. A. Mr. Hoskins' staff consists of Lloyd Aldrich, assistant highway engineer; Travis B. Townsend, chief deputy, and Joseph Maguire, chief draftsman.

J. W. LOWELL, assistant division engineer of the Universal Portland Cement Co. for the past two years, and connected with the company since 1912, has been appointed to succeed K. H. Talbot as division engineer at the Pittsburgh office. Mr. Talbot has been in charge of Pittsburgh activities of the promotion bureau since 1914. G. S. Eaton succeeds Mr. Lowell at Chicago with title of assistant division engineer, and G. E. Warren has been made division engineer at Chicago.

H. G. SHIRLEY, state highway engineer of Maryland, has been selected as secretary of the Highway Industries Association.

JAMES W. MORRIS, former city engineer of Portland, Ore., who has been in the Engineer Reserve officers' training camp at Camp Lee, Virginia, has been assigned as captain to the 317th engineers (pioneers) in Chillicothe, Ohio.

J. WALDO SMITH, New York, chief engineer, Board of Water Supply, City of New York, received the honorary degree of doctor of engineering at the commencement exercises of Stevens Institute of Technology Apr. 2.

ROBERT S. PARSONS, of Nutley, N. J., assistant to President Underwood of the Erie RR., has been appointed by Governor Edge of New Jersey to succeed the late Col. Edwin A. Stevens as a member of the State Highway Commission. Mr. Parsons is a graduate of Rutgers College and an engineer. He will fill one of the two positions on the highway commission that under the new law must be held by engineers.

BRIG. GEN. ISAAC W. LITTELL, Quartermaster Corps, U. S. A., who was head of the cantonment division up to a month ago, has been detailed as a member of the army retiring board.

A. G. HILLBERG, consulting hydraulic engineer, and formerly associate editor of the *Engineering Record*, left last week for Manila, P. I., to become chief engineer and manager of the engineering and contracting department of the Pacific Commercial Company.

CARL F. MEYER, formerly chief engineer for Morell & Nichols, Minneapolis, and in charge of the industrial housing project at Morgan Park, Duluth, Minn., has resigned his position with Morell & Nichols to accept that of construction engineer for the Morgan Park Co. at the same place.

HUGH L. COOPER has been promoted from lieutenant-colonel to colonel, Engineer Reserve Corps, National Army. Colonel Cooper is now in charge of the construction of the Muscle Shoals Dam in Alabama.

CHESTER A. SMITH, Burns & McDonnell, consulting engineers of Kansas City, Mo., has accepted an appointment as captain in the sanitary corps of the National Army, and has reported for service at Fort Oglethorpe, Ga. Captain Smith is 36 years of age and a graduate of Kansas State University. He has been with the firm of Burns & McDonnell nine years.

RAYMOND G. UPTON, assistant sanitary engineer, Texas State Board of Health, has received a commission as first lieutenant in the sanitary corps of the medical department, National Army. He is stationed at Fort Leavenworth.

H. L. PHELPS, engineer of Cedar County, Ia., has resigned his position to become district engineer with the Iowa State Highway Commission, located in Cedar Rapids.

L. M. MARTIN, district engineer for the Iowa State Highway Commission, located at Atlantic, was granted leave of absence to go into training for a captaincy in the engineering corps. By reason of an accident he has been honorably discharged and has returned to take up his former work.

GEORGE E. TEBBETTS, bridge engineer of the Kansas City Terminal Ry. Co., has received a leave of abscence and has accepted a civilian position with the Emergency Fleet Corporation, Washington. Mr. Tebbetts had charge of the design of the high-line viaduct from the new station to Kansas City, Kan., described in *Engineering News-Record* of Mar. 7, p. 466. This structure is now being completed rapidly.

R. K. BROWN, engineer of maintenance of way of the Los Angeles & Salt Lake Ry., has been appointed division engineer at Salt Lake City, Utah.

OBITUARY

COL. WILLIAM L. GUTHRIE, Engineers, National Army, and major, Corps of Engineers, U. S. A., died Apr. 8 at Camp Zachary Taylor, Kentucky, where he had been in command of the 309th Engineers. Col. Guthrie was graduated from West Point in 1901 and had served up to the beginning of the war in the Corps of Engineers, his last post being in charge of the Mobile district.

REAR ADMIRAL JOHN D. FORD, U. S. N., retired, died in Baltimore Apr. 8. Rear Admiral Ford was born in Baltimore, May 9, 1840, and was graduated from the Maryland Institute and School of Design and later from the Potts School of Mechanical Engineering. He entered the United States Navy as a third assistant engineer in 1862, serving throughout the Civil War. In 1864 he was a first assistant engineer, and was promoted in 1890 to chief engineer. During the Civil War he took part in the recapture of Baton Rouge and the battle of Mobile Bay. In 1898 Rear Admiral Ford took part in the actions of May 1 and Aug. 31 in the destruction of the Spanish fleet off Cavite. He retired May 2, 1902, with the rank of rear admiral.

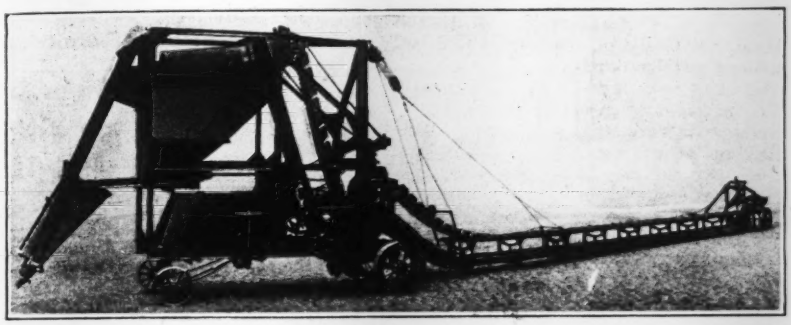
GEORGE TICE, JR., assistant engineer, Bureau of Public Buildings and Offices, Brooklyn, N. Y., died Mar. 20. He was 43 years old and had been in the municipal service thirty years.

NEWS OF ENGINEERING INDUSTRIES

FOR MANUFACTURERS WHO SERVE ENGINEERS AND CONTRACTORS

Loading Machine Replaces Hand Labor at Concrete Mixer

Power loading, screening and automatic measuring of aggregate are performed by a machine designed for use with a concrete mixer as either a portable or a stationary plant. The machine is operated by one man and hand labor required where charging is is said to save from 66 to 75% of the done by wheelbarrows.



LOADER DELIVERS SCREENED AND MEASURED AGGREGATE TO MIXER

Both sand and stone are shoveled upon a single horizontal conveyor which feeds an elevating conveyor discharging into a rotary screen, where the materials are separated and delivered to their respective bins. A measuring hopper beneath the bins takes a charge of aggregate, and swings outward to dump into the skip of the mixer, as shown in the accompanying view. Then it returns into position beneath the bins and is reloaded automatically. The hopper has two compartments which can be adjusted for any desired proportions of sand and stone. For bank-run gravel a larger screen and one-compartment hopper may be used. Cement is charged into the skip by hand in the usual way.

Shoveling is facilitated by the use of the lower run or strand of the conveyor for delivery. As this is only about 7 in. from the ground the work is facilitated, and some of the shovelers, as well as all of the wheelers, may be dispensed with. The conveyor is 22 in. wide and 50 ft. long, made in 10-ft. removable sections, with its outer end supported on wheels. It can be swung laterally through an angle of 180 deg. for contact with the piles of material. When the machine is to move forward, the conveyor is raised at the middle by the cables and a power hoist, thus reducing its length. This can be done and the machine advanced 10 or 15 ft. in about 30 sec. To prevent accidents, the hoist is so interlocked with the propelling mechanism that the machine cannot be moved until the conveyor is raised, and the conveyor cannot then be lowered until the machine is at rest.

On road or street work, sand and stone may be deposited in two parallel piles on opposite sides of the machine, or they may be all on the same side, as the screening and proportioning of the batch by the measuring hopper make it unnecessary to keep the materials separate. This plan leaves one side of the road clear for bringing up extra material if required. The automatic measuring in combination with the screening just before use is considered of special advantage.

The machine has a total length of 67 ft. 6 in.; width, 6 ft. 10 in.; height, 12 ft. 7 in.; wheel gage, 5 ft. 8 in.; weight, about 5¾ tons, including the gasoline engine. It is built by the Stamp Loading Machine Co., Milwaukee.

Promoting Faster Car Unloading in New England Mill

New England has been a leader among the great industrial centers in conserving its resources in man-power —in aiding its men to deliver increased output to the nation by the means of modern machinery. Coal shortage and car shortage have hampered the work of New England mills. Men have been scarce. High demurrage charges have spurred the rapid unloading of cars.

The illustration shows the way in which the Lafayette Worsted Co., Woonsocket, R. I., handles its coal cars. With a Thew electric crane, recently developed by the Thew Automatic Shovel Co., Lorain, Ohio, equipped with a ¾-yd. clamshell bucket, two men unload a 50-ton car of coal in 55 minutes. Formerly 8 or 10 men had to be called from other work about the plant to unload coal, and a single car sometimes took a full day.

The crane is operated by a single 20 hp. motor, which drives the drums and swinging mechanism by a system of planetary gears. Ordinarily only 10 to 12 hp. are required for operation and the cost of power amounts to about $1.50 for a 10-hour day. One man works the crane and one trims the coal.

Replacing the Wheelbarrow for Handling Coal and Ashes

While the modern industrial plant usually has full equipment for handling coal and ashes, many small boiler rooms built some years ago still use wheelbarrows and hand labor. The shortage of men has made itself felt in boiler rooms now, and the Link Belt Co., Philadelphia, was called upon recently to build ash-handling equipment for one of these older plants.

A mono-rail electric hoist was selected for this installation. This machine runs on the lower flange of an I-beam track. It is operated by a man traveling in a trailer cage, who con-

ELECTRIC LOCOMOTIVE CRANE UNLOADS CAR IN 55 MINUTES

trols the raising or lowering of the bucket, as well as the travel of the hoist. The mono-rail track continues out over a railroad siding, where the

CONVEYING ASHES TO CARS

ashes are dumped into gondola cars. The laborers who clean the fires fill the bucket with ashes.

About 30 tons of ashes are handled daily. They are pulled out every six hours. Two men do the work of shoveling the ashes into the bucket, and then often one of them gets into the cage and runs it out over the car on the siding. At other times, to hurry the work, an additional man operates the hoist, remaining in the cage. The bucket has a capacity of 1¼ cu.yd., and is handled by a two-ton electric hoist.

A New Man-Saver for the Road Maintenance Job

To meet the pressing need for highway maintenance in spite of reduced labor forces, the Burch Plow Works Co., Crestline, Ohio, has brought out an improved model of its stone spreader and distributor.

This rig consists of a box 7 ft. 4 in. wide, built of 10 gage steel plate, with adjustable end gate. It is attached to

WINGS SPREAD MATERIAL FULL WIDTH OF ROADWAY

the rear of a back dumping truck and spreads and distributes the rock, sand or gravel, the full width of a roadway.

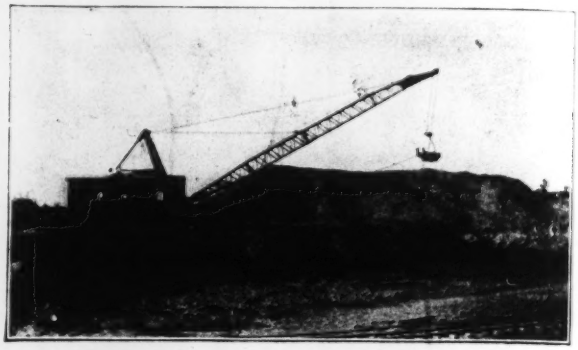
The illustration shows the machine in action, spreading a width of about 20 ft., and represents the first model, which was built of wood. The latest model of the machine, which is now on the market, is made of steel throughout. It eliminates an entire spreading gang.

Electric Dragline Digs Hard Material for 4¼ Cents a Yard

A Year's Big Stripping Job Affords Interesting Data on Costs

One year's record in digging 256,710 cu.yd. of earth and rock with an electric dragline excavator at the Locust Mountain Coal Co., Shenandoah, Penn., showed a labor cost of 2.19c. per cu.yd. The power and material costs were only making the total 2.04c. per cu.yd., yardage cost 4.23c. Electric operation is credited with the low unit costs developed.

The stripping job resembles excavation on general construction work closely enough to make the data of interest in the contracting and industrial fields. Excavation ranged from 14 to 30 ft. deep, rock being drilled and shot wherever it was uncovered. The cut had a maximum width of 150 ft. Spoil was sidecast clear of the coal vein. In addition to several laborers in the pit, the only men required for operating the entire plant were the dragline operator and an oiler.



DRAGLINE EXCAVATES WIDTH OF 150 FT.

A 3½-cu.yd. dragline bucket was used, suspended from the boom by a 3-part hoist line. The machine has a 24-ft. diameter turntable operated by a 75-hp. motor. The hoist motor is 150 hp. They operate on 440 volt 3-phase, 60-cycle current.

By a magnetic control panel digging characteristics are obtained similar to those of a steam-operated machine. When hard digging is encountered and the hoisting motor stalls, power is still applied to the motor to enable the bucket to continue digging through the hard material, instead of causing circuit breakers to open and depriving the operator of control as in the earlier types of electrical drive. The main motor controller is equipped with jamming relays which automatically cut the resistance into the rotor circuit when the motor is stalled. Similar equipment protects the swinging motor and permits the operator to advance the controller quickly and to reverse at full speed.

Classification	Labor — Amount	Labor — Per Yard	Material — Amount	Material — Per Yard	Total Cost Per Yard
Shovel crew	$1,463.50	$0.0057	$82.76	$0.0003	$0.0060
Pitmen	1,697.80	.0066	5.16	.....	.0066
Blasters	107.02	.0004	1,804.22	.0070	.0074
Repairs and maintenance	317.08	.0012	1,274.89	.0050	.0062
Electric repairs and maintenance	318.64	.0012	16.24	.0001	.0013
Transmission lines	74.56	.0003	7.60	.....	.0003
Power	.....	.....	2,038.26	.0079	.0079
Foremen, etc	339.16	.0013	2.25	.....	.0013
Clerk	40.50	.0002	.....	.....	.0002
Hauling	36.73	.0001	.....	.....	.0001
Miscellaneous	1,236.88	.0048	13.00	.0001	.0049
Total	$5,631.87	$0.0219	$5,243.88	$0.0204	$0.0423

The detailed costs of excavating and sidecasting 256,710 cu.yd. of earth and rock on this job are shown in the accompanying table.

The data on this excavating operation were furnished by the Cutler-Hammer Mfg. Co. of Milwaukee, makers of the electrical control apparatus used on the dragline excavator.

Truck Beats Freight Schedule

In making a 533-mile trip overland from New York to Akron, Ohio, in 60 hours total time, and in 49 hours actual running time, a loaded 3½-ton Mack truck recently beat the fastest freight delivery by 48 hours. This was one of the truck fleet of the Goodyear Tire and Rubber Co., which maintains a through truck service between Akron and Boston. The rubber company now

has eight trucks running on regular schedule. The trucks were operated through the deep snows during the entire winter.

Special Liberty Loan Committee for Machine Trades

A special Liberty Loan committee has been organized for the machinery and machine-tool trades. The officers of the committee are: Chairman, J. W. Lane, president, E. W. Bliss Co.; director of speakers, Norman Dodge, vice president, Mergenthaler Linotype Co.; vice chairman, R. L. Patterson, president, American Machine & Foundry Co.; publicity director, Charles A. Hirschberg, publicity manager, Ingersoll-Rand Co.; secretary, Charles B. Houston, of the E. W. Bliss Company.

Government Warns Against Manufactured Anti-Freezing Compounds

Warning against the indiscriminate use of prepared anti-freezing compounds for automobile and motortruck radiators has been issued by the U. S. Department of Commerce. The Government bulletin cautions against the use of calcium chloride compounds on account of their corrosive action on soldered joints and the tendency to deposit large crystals in the radiator. Kerosene or similar oils should not be used on account of their inflammability and high boiling point. Mixtures of glycerine and alcohol are not commended because of the need for glycerine in the manufacture of explosives. Solutions of denatured alcohol are preferred to wood alcohol because of the occasional occurrence of free acetic acid in wood alcohol. The denatured alcohol mixture retains its anti-freezing properties after long use, is free from corrosive action, and does not materially change the boiling point of water.

Census Shows Expansion of Canadian Industries

The industrial census of Canada for the year 1915, which has just been issued, shows a general expansion in the manufacturing business of the Dominion. The number of establishments in operation is given as 21,306, representing an invested capital of $1,995,103,272, employing 52,683 persons on salaries and 462,200 on wages, and producing goods to the value of $1,407,137,140 from raw materials valued at $802,135,862.

During the period from 1905 to 1915 the number of manufacturing establishments in Canada increased by approximately 34%; capital, by 135%; employees on salaries, by 44% employees on wages, by 29%; salaries, by 96%; wages, by 70%, and the value of the products by 95%; the value of the total industrial products in the year 1905 was $718,352,803, as against $1,407,137,140 in 1915.

Water-Works Manufacturers Tell of Difficulties

Experiences With Priority Orders and Moving Supplies—Suggestions Made For Relief

Continuing along broader lines the investigation of difficulties in getting shipments of liquid chlorine for water-purification works, reported in *Engineering News-Record*, April 4, p. 688, on inquiry was addressed to some 250 concerns, mostly members of the Water-Works Manufacturers' Association, asking for their experiences in obtaining shipments of water-works supplies by means of priority orders or otherwise. Although the first installment of replies, printed herewith, shows some discouragement and many delayed shipments, a fair percentage of the returns indicate either no or little serious difficulty and for the most part a hearty spirit of coöperation with the federal authorities in meeting the burdens of war conditions is manifested. Some constructive criticism is presented. The replies follow:

E. B. Badger & Sons Co., Boston, Mass.—As the majority of the work we are now doing is government work, we have experienced very little trouble in getting priority certificates on car movements.

Harold L. Bond Co., Boston, Mass., U. S. A.—We had difficulty in getting car priority orders in one instance which we think deserves public attention. We were in urgent need of a carload of hickory dowels, to be used in manufacturing sewer rods. We had several government orders awaiting the arrival of these dowels and quite a large number of orders from different cities. In fact, the urgency was such that we were able to obtain a Class A priority from the U. S. Priorities Committee. Upon receipt of this priority, the manufacturer completed the dowels and had them ready for shipment, fully a month ago. We have not yet been able to get permission from the Director of Inland Transportation to have shipment made. It certainly does seem inconsistent to be unable to obtain permission to make shipment in a case where the urgency was such that we were granted Class A priority.

B. F. Sturtevant Co., Boston, Mass.—We have not experienced trouble in getting our car supply.

Norwood Engineering Co., Florence, Mass.—We are experiencing some difficulty but we realize the unsettled condition of the railroads and the great demand upon them for moving war material, and presume that this condition will exist as long as the war lasts.

A Wyckoff & Son Co., Elmira, N. Y.—We have been on government work for practically a year and have not had any trouble in getting the railroads to accept or deliver government shipments. It is another story on other shipments. Our priority orders assist us greatly in getting materials shipped in to us.

Coldwell-Wilcox Co., Newburgh, N. Y.—We have not as yet experienced any difficulty in obtaining sufficient car supply.

Pacific Flush-Tank Co., New York—Anything that can be done to relieve the present situation, which relates not only to the prompt delivery of equipment, rendered almost impossible by the embargoes that are being placed, but also to the difficulty of securing basic materials, would be gratefully received by any corporation which desires to do business at this time. Authoritative "stickers" should be furnished by the government to credited purchasers, whether government employees direct, or contracting or engineering concerns authorized to purchase for the government. We have had considerable trouble in the past and see no relief in sight.

Worthington Pump and Machinery Corporation, New York—We do not feel that we have been discriminated against to any appreciable extent, and have probably been as much inconvenienced as anybody, but we have no thought, nor have we ever had the thought of protesting, in view of our decided opinion that it behooves every concern to support the government to its fullest extent.

Ross Valve Mfg. Co., Troy, N. Y.—We have had material for a North Carolina water-works held up for three weeks or more, no freight or express being accepted for points South. Our customer will have to grin and bear it, as we cannot split up the valve and send it parcel post.

Eddy Valve Co., Waterford, N. Y.—We have no special complaint to make except that we were very much delayed during the past season in receiving certain shipments of fuel, and from time to time are embargoed from making shipment of material over different railroads.

The A. P. Smith Mfg. Co., East Orange, N. J.—Our experience has been that for general water-works goods unless same were for immediate use on cantonment construction—or other work covered by the government—priority certificates would not be issued. As a result, we have had difficulty at various periods within the past six months, where we were not able to ship water-works goods to various parts of the country due to embargoes by the railroads. Our further experience has been that when we were able to make shipment after embargoes were lifted for a short period it meant, in a great many instances, weeks before goods reached destination; and, in addition to this, after goods had arrived at destination it was found that some part of the shipment was invariably lost in transit so that within the past six to eight months our bills against carriers have been greater than in our whole experience of manu-

facturing, such bills being made to cover duplicate shipments which we were obliged to make in order to help our customers out.

The Leadite Co., Philadelphia, Pa.—We have experienced considerable difficulty in getting the carriers to accept shipments owing to embargoes. We also learn that other manufacturers of water-works supplies are having the same trouble. If the Embargo Bureau could be made to realize the importance of a town's or city's water-supply in relation to the health of the citizens, we believe that water-works supplies would be put on the same basis as food and fuel, or at least only secondary thereto.

Simplex Valve and Meter Co., Philadelphia, Pa.—We have encountered serious delays due to embargoes covering the shipment of rate controllers, filter gages and meters. We have not had occasion to apply for car priority orders, since in almost every case the material has been furnished to the order of a filter contractor, city department, or water-works corporation. We do not know how much difficulty these folks have had in connection with getting priority orders. The only priority orders which have been issued to us have been for material consigned to water-works extensions essential to the maintenance of cantonments, or for government extensions to arsenals, powder plants, and the like.

Epping-Carpenter Pump Co., Pittsburgh, Pa.—We are of the opinion that if priority order numbers were furnished with orders for water-works equipment they would help in making early deliveries. All materials for coal mines have priority numbers and in these times, when most manufacturers are engaged mostly on government work, material ordered having priority numbers is always given preference. The railroads always give preference to shipments with priority numbers.

Struthers-Wells Co., Warren, Pa.—We are not having much trouble at this time in securing all of the cars which we require for our shipments. We have experienced short delays on some of our orders, but generally speaking have no complaint to make along this line.

York Manufacturing Co., York, Pa.—Most of our applications for shipping permits have been allowed, but these permits were obtained from the railroad companies and not from Washington.

U. S. Sanitary Septic Tank Co., Memphis, Tenn.—We have experienced very little trouble. However, in buying we usually know anywhere from three to four months ahead of time exactly what will be necessary, and we close for this material, which gives about sixty days for delivery.

The John H. McGowan Co., Cincinnati, Ohio—We doubt the advisability of dealing with the difficulty being encountered in securing car priority order in the movement of material, even though there appeared to be a clear demand for haste in the interests of public health, for the reason that the U. S. Shipping Board, Emergency Fleet Corporation, have not been able to overcome the difficulty themselves. We are operating our plant up to about 90% of our capacity for this department of the government, and in a number of cases the railroads have refused to accept shipments according to instructions given us. They have also experienced considerable delays in having embargoes lifted on the shipment of material from various points that was required in the shipbuilding programme which you, of course know, ranks as Class A priority.

Glauber Brass Mfg. Co., Cleveland, Ohio—We have been up against it for some time and it did not make any difference to whom the material was consigned. When the embargoes were on certain points the railroads would not receive shipments. We even had them refuse material consigned to the Emergency Fleet Corporation that was actually needed in the construction of ships, and we had to resort to notifying the government inspector, who found a way of getting the material through. Among the shipments held here for some time against embargoes there were no doubt quite a few water-works orders. We believe that if the embargoes are in any way affecting the public health it would be a good thing for the Water-Works Manufacturers' Association and the American Water-Works Association to use their efforts to secure priority orders covering such shipments.

The Toledo Pipe Threading Machine Co., Toledo, Ohio—Although we have made numerous efforts to secure priority orders, thinking they might be of use to us in our own efforts to secure raw material, we have never been able to secure a single such document.

Many orders have come to us from our jobbing connections for tools and supplies needed by the government, either directly or indirectly, in the prosecution of its war program. With our desire to supply this need as promptly as possible, we have filled these orders without waiting for the priority certificates which we have demanded but finally have despaired of ever getting.

We are at this writing approximately three months behind in production. Despite this fact, we are taking care of government requirements, either direct or indirect, practically on receipt of orders. In doing this, we are all the time sapping our supply of raw material, and assurance that we will be able to secure further supplies at all promptly is growing more remote, owing to the fact that the government is apparently commandeering a very large part of the productive capacity of the mills from which the raw material required by us must be secured.

In our case, at least, many of the needs of the various governmental activities can be best supplied through jobbing houses, and most of our orders for government requirements come to us from jobbers.

Anything that will enable these jobbers of mill and plumbing supplies throughout the country, or at least in the localities where government work is being done, to secure official priority certificates with proper safeguards to insure these certificates not being issued promiscuously, would, it seems to us, be helpful to manufacturers, many of whom must be up against the same conditions we are.

Indiana Air Pump Company, Indianapolis, Ind.—Cars have been furnished fairly promptly, but that is where the performance ends. This applies with double force to less than carload shipments, whether by freight or express.

C. D. Butchart Co., Denver, Colo.—We have not had difficulty in getting cars of some kind for the shipment of our products, and the shipments have gone through, generally, in but little longer than the usual time. We have had difficulty and delay in getting certain necessary supplies, and if a local priority board could be established here in Denver to pass upon and classify a manufacturer's products, so that incoming, as well as outgoing, shipments could be marked with the governing classification, this classification to insure handling accordingly, with the misuse of the classification penalized, we believe some delay might be eliminated.

BUSINESS NOTES

Walter N. Crafts has resigned as president and treasurer of the Crucible Steel Forge Co., Cleveland, Ohio, and has become assistant general superintendent of the British Forgings, Limited, Toronto, Canada. He is in special charge of the electric steel furnace plant.

The United States Steel Co. will start work immediately on a four-unit plant at Everett, Wash., south of the Sumner Iron Works. The plant will include a gaspipe factory, a unit for the manufacture of nuts and bolts, one for making railroad spikes and one for making commercial steel bars.

Harry C. Stalley has recently become manager of the Advance Engineering Co., Cleveland, bucket manufacturers. Mr. Stalley has been connected for the past two years with the West Steel Casting Co. as engineer, and prior to that was in inspection work with the City of Cleveland bridge department.

The Pittsburgh Testing Laboratories have turned over their building and equipment at Seventh and Bedford Avenues, Pittsburgh, to the Government for the duration of the war. From Apr. 1 to about June 15, the offices of the Pittsburgh Testing Laboratories will be in the B. F. Jones Building, Fourth Ave. and Ross St., and after that time will remove to 620 Grant St., the building being remodeled for the purpose.